

Project Manual

DATE: July 19, 2023



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Health

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Facility Renovation Family Health Services of Darke County

5735 Meeker Road
Greenville, Ohio 45331

App  **Architecture**
creative focused design

615 Woodside Drive, Englewood, Ohio 45322

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PROJECT NUMBER: 3853.03

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DOCUMENT 001116 - INVITATION TO BID

PART 1 - GENERAL

1.1 PROJECT INFORMATION

- A. Notice to Bidders: Prequalified bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.
- B. Project Identification: Facility Renovation Family Health.
 - 1. Project Location: 5735 Meeker Road, Greenville, OH 45331.
- C. Owner: Family Health Services of Darke County.
 - 1. Owner's Representative: Jared M. Pollick, Executive Director.
- D. Architect: App Architecture, Inc., 615 Woodside Drive, Englewood, OH 45322, 937.836.8898.
 - 1. Project consists of the existing West Building: 46,200 SF of Medical Clinic and Office Space, a new 2-hour fire wall, and the new East Building: 43,700 SF of Medical Clinic, Office, and Assembly space. West Building work will include the addition of sprinklers to the original 1986 building, 5,000 SF of infill additions to the 2006 building and limited interior renovations. East Building will be a 2-story new construction building. And other Work as indicated in the Contract Documents.
- E. 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. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:
 - 1. Bid Date: August 9, 2023.
 - 2. Bid Time: 2:00 PM, local time.
 - 3. Submit bids electronically to maria.schertler@app-arch.com, followed up with an original signed copy via USPS, to App Architecture, 615 Woodside Drive, Englewood, OH 45322.
- B. Bids received on time will be thereafter privately opened. Any bids received late are subject to not being considered.

1.3 PRE-BID CONFERENCE

- A. A pre-bid conference for all bidders will be held at Family Health, Greenville campus on July 28, 2023 at 11:30 AM, local time. Meet in the lobby of the Main Entrance (large canopy). Prospective General Contractors are required to attend. Major trade sub-contractors are welcome to attend but not required.

1.4 DOCUMENTS

- A. Online Procurement and Contracting Documents: Access to download documents will be provided via email on July 19, 2023. Access to download documents will be provided to General Contractor bidders only. Distribution to sub-contractors will be the responsibility of General Contractors.
 - 1. Direct all bid questions and substitution requests in writing to Maria Schertler via email. All substitution requests due no later than July 31, 2023 at 12:00 PM. All bid questions due no later than August 2, 2023 at 12:00 PM.

1.5 BIDDER'S QUALIFICATIONS

- A. Bidders must be prequalified by Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 001116

DOCUMENT 002113 - INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 INSTRUCTIONS TO BIDDERS

- A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.
 - 1. A copy of AIA Document A701, "Instructions to Bidders," is bound in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 002113

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AIA® Document A701® – 2018

Instructions to Bidders

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

Facility Renovation
Family Health Services of Darke County
5735 Meeker Road
Greenville, Ohio 45331

Project consists of the existing West Building: 46,200 SF of Medical Clinic and Office Space, a new 2-hour fire wall, and the new East Building: 43,700 SF of Medical Clinic, Office, and Assembly space. West Building work will include the addition of sprinklers to the original 1986 building, 5,000 SF of infill additions to the 2006 building and limited interior renovations. East Building will be a 2-story new construction building. And other Work as indicated in the Contract Documents.

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

Family Health Services of Darke County
5735 Meeker Road
Greenville, Ohio 45331

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

App Architecture, Inc.
615 Woodside Drive
Englewood, Ohio 45322

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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.

ARTICLE 1 DEFINITIONS

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

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

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

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

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

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

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

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

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

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

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

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

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

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

Access to download documents will be provided via email to General Contractor bidders only. Distribution to sub-contractors will be the responsibility of General Contractors.

§ 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.

N/A

§ 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.)

Submitted to Architect via email no later than August 2, 2023, 12:00 PM.

§ 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 via email no later than July 31, 2023, 12:00 PM.

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

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

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

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

§ 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.)

Addenda will be transmitted by email.

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

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

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

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

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

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

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

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

N/A

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

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

§ 4.2 Bid Security

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

(Insert the form and amount of bid security.)

N/A

§ 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.)

Bids are to be submitted electronically to maria.schertler@app-arch.com, followed up with an original signed copy via USPS to App Architecture, 615 Woodside Drive, Englewood, Ohio 45322.

§ 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.)

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 privately opened.

§ 5.2 Rejection of Bids

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

§ 5.3 Acceptance of Bid (Award)

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

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

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

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

§ 6.2 Owner's Financial Capability

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

§ 6.3 Submittals

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

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

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

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

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

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.)

.5 Drawings

Number	Title	Date
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.6 Specifications

Section	Title	Date	Pages
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.7 Addenda:

Number	Date	Pages
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.8 Other Exhibits:

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

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

The Sustainability Plan:

Title	Date	Pages
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Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
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.9 Other documents listed below:

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

DOCUMENT 003132 - GEOTECHNICAL DATA

PART 1 - GENERAL

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 Geotechnical Consultants, Inc., dated April 19, 2023, 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 003132

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GEOTECHNICAL
CONSULTANTS INC.



GCI PROJECT No. 23-G-27587

Subsurface Exploration and Geotechnical Engineering Report

Proposed Family Health Facility Expansion
5735 Meeker Road
Greenville, Ohio

Prepared for:
Family Health Services of Darke County, Inc.

April 19, 2023



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April 19, 2023

Mr. Jared Pollick, Executive Director
Family Health Services of Darke County, Inc.
5735 Meeker Road
Greenville, Ohio 45331

**Reference: Subsurface Exploration and Geotechnical Engineering Report
Proposed Family Health Facility Expansion
5735 Meeker Road - Greenville, Ohio
GCI Project No. 23-G-27587**

Dear Mr. Pollick:

As you authorized, Geotechnical Consultants, Inc. (GCI) has performed a subsurface exploration and prepared a geotechnical engineering report for the above referenced project, which includes two building additions and a parking lot expansion.

In summary, 8 of the 9 borings found existing fill soils, ranging in depth from 0.3 foot to 4 feet in depth. The upper portion of the fills typically consisted of re-spread topsoil, with the underlying fills consisting of heavily stained lean clays mixed with or interlayered with brown sandy lean clays. Natural soils found below the fills consisted of heavily stained relatively plastic lean clays that were underlain by brown and/or gray glacial tills that were interlayered with sand deposits. We did not encounter bedrock within the depths of the borings (maximum drilled depth of 25 feet). Groundwater seepage was encountered in the building borings at depths ranging from 6 to 13 feet, commonly at 6 to 7 feet, at or near the bottom of the stained lean clay stratum.

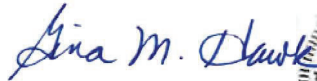
GCI is of the opinion that the medium stiff to stiff unstained natural cohesive site soils and the medium dense to dense natural granular soils are suitable for the support of the proposed construction. In our opinion, the primary geotechnical concerns for the project are associated with the existing site development (e.g., the presence of existing fills of varying depth and consistency, existing utilities that will need to be rerouted, etc.), the presence of heavily stained and plastic natural lean clay soils below the fills, and site preparation issues. **We feel that remediation of the existing fills and the organically stained natural soils will be needed to obtain suitable support for the proposed construction**, either in the form of fill/stained soil removal and replacement, in-situ fortification through the installation of rammed aggregate piers, or by extension of footings to stable, non-organic natural soils.

We discuss geotechnical considerations in more detail in the attached report. Provided these considerations are properly addressed during construction, it is GCI's opinion that the site should be suitable for the proposed development using shallow foundations (extended as needed), slab-on-grade, and flexible or rigid pavements. *We recommend*

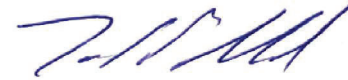
that GCI be provided with the proposed grading plan, when available, for our review and comment.

After you have reviewed the report, feel free to contact us with any questions you may have. We appreciate the opportunity to provide our services for this project and hope to continue providing our services through construction.

Respectfully submitted,
Geotechnical Consultants, Inc.



Gina M. Hawk, P.E.
Senior Project Engineer



Todd R. Meek, P.E. LEED AP
In-House Reviewer

Distribution: Jared Pollick @ Family Health Services of Darke County – PDF via email
Maria Schertler & Todd Gindelberger @ App Architecture – PDF via email
GCI File 23-G-27587

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INTRODUCTION

As authorized by Mr. Jared Pollick of Family Health Services of Darke County, Inc., Geotechnical Consultants, Inc. (GCI) has performed a subsurface exploration and prepared this geotechnical engineering report for proposed building and parking lot additions to the existing Family Health facility located at 5723 Meeker Road in Greenville, Ohio. Prior to drilling, GCI was provided with a scope of geotechnical services document (prepared by App Architecture and dated 02/09/23), a proposed boring location plan (prepared by the structural engineer Shell + Meyer Associates, Inc. and dated 01/26/23), and a set of plans for the proposed facility renovations (drawings G0.1 through G0.3 and A1.2.0 and A1.2.1, prepared by App Architecture and dated 02/27/23).

Our subsurface study consisted of seven standard penetration borings drilled within the proposed building addition areas (note that the number and locations were somewhat modified from those proposed by the structural engineer), two shallower borings (one performed as a hand auger boring) in the planned south parking lot expansion, and limited laboratory testing. We located the borings using the provided site plan, GIS coordinates, and hand-held GPS equipment; boring locations should be considered approximate. Topographic information was not provided, and we did not determine ground elevations at the boring locations within our scope of services. We have attached a sketch showing the proposed site layout and approximate boring locations overlaid on a recent aerial photograph. Copies of the boring logs also are included in the appendix.

The intent of this study was to evaluate subsurface conditions and offer geotechnical recommendations relative to earthwork, foundations, slabs, and new pavements for the proposed building and parking lot additions. This report is issued prior to the receipt of a

proposed grading plan. **GCI should review final site layout and grading plans when available, and provide additional recommendations and borings, if necessary.**

We have prepared this report for the exclusive use of Family Health Services of Darke County, Inc. and their consultants for specific application to the above referenced project at 5735 Meeker Road in Greenville, Ohio in accordance with generally accepted soil and foundation engineering practices. We make no warranty, expressed or implied.

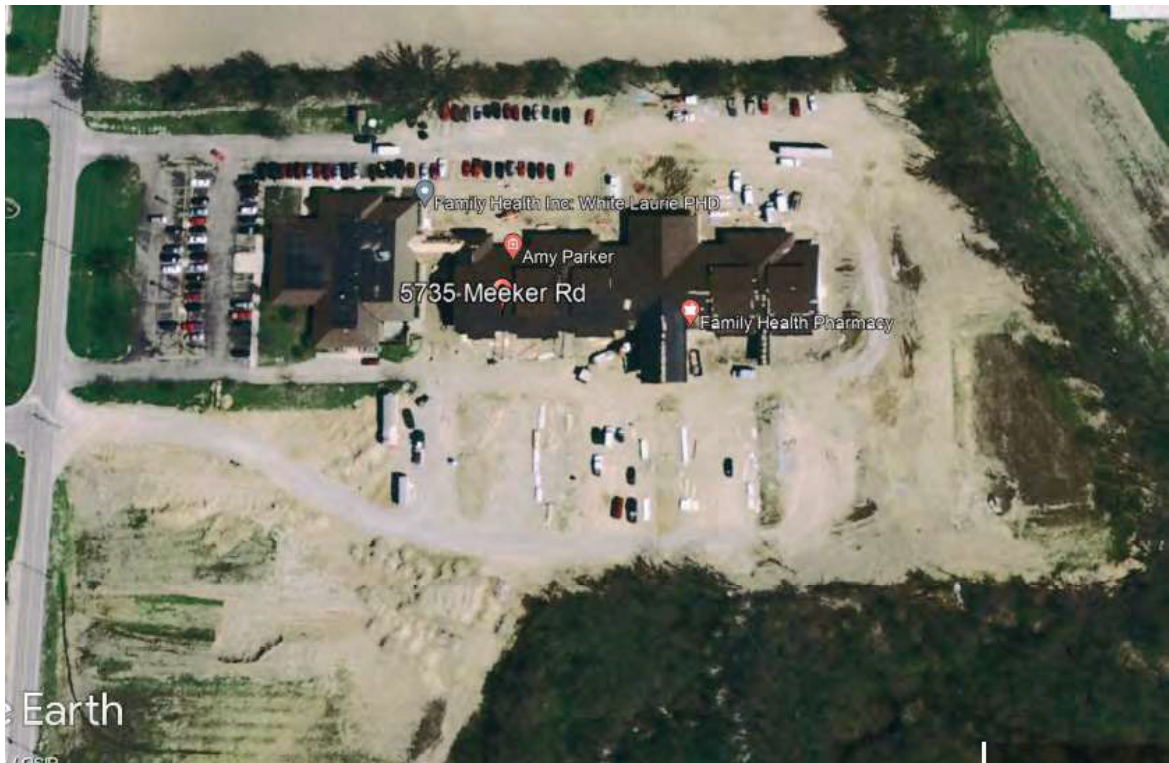
SITE LOCATION AND PROJECT DESCRIPTION

The site is part of a 22.88±-acre irregularly-shape parcel that is located on the south side of Greenville (Darke County), Ohio. The overall tract is bounded by Meeker Road to the west, a tree line and medical building beyond to the north, railroad tracks to the northeast, and Bridge Creek to the southeast. The site is shown on a *General Site Location Map* in the Appendix and in the below aerial photograph.



Site Aerial Photograph (Courtesy: Darke County Auditor)

There are two existing buildings on the tract (address: 1535 Meeker Road), along with existing parking and drive areas and a detention pond at the east end. According to the Darke County Auditor's website, the west building is a one-story, 14,212 square-foot, slab-on-grade medical office that was constructed in the 1980's. The east building is a 27,821 square foot slab-on-grade medical office that was built circa 2006, along with the south parking lot. The pavement that originally crossed through the currently planned "infill" area between the two buildings was removed and replaced with greenspace as part of that construction. The detention basin also was added at that time; using Google Earth to estimate surface elevations, we believe the pond is roughly 4 to 5 feet in depth. As can be seen in the 2007 aerial photograph below, the currently planned east building addition footprint and the non-wooded portion of the parking lot expansion were disturbed during 2007 construction.



April 2007 Aerial Photograph (Courtesy: Google Earth)

We assume the existing buildings have structurally performed satisfactorily to date.

Site topography slopes down towards Bridge Creek, which flows to the south/southwest along the southern site border. The 2019 Greenville West and East USGS topographic maps (see attached) show surface grades within the existing building and proposed addition areas to be between elevations 1030 feet and 1025 feet, dropping to near elevation 1020 feet at the south end of the planned parking lot expansion. The maps have blue "freshwater emergent wetland" symbols shown to the immediate north and south of the overall tract, denoting marshy soils. Review of the 1961 version of the same USGS maps (see attached) shows the site was vacant at that time, with grades slightly higher at the north end of the property (i.e., the elevation 1030-foot contour crossed through the property at that time, rather than just off-site to the north).

The USDA web soil survey maps the site as having Patton silty clay loam, 0 to 2 percent slopes (Pa) and Miamian silt loam, 2 to 6 percent slopes (MmB); see attached map. Patton silty clay loam soils are characterized as deep, poorly drained glacio-lacustrine deposits, having been deposited on nearly level to depressional parts of glacial lake plains and stream terraces; they often are stained near the surface and underlain by stratified silty and loamy deposits. Miamian silt loam soils are characterized as comparably well drained glacial till plain deposits.

The proposed project consists of constructing a one-story, slab-on-grade "infill" area (approximately 3,400 square feet in size) between the two existing buildings and a two-story slab-on-grade addition (29,150 square feet on the first floor and 15,550 on the second floor) at the east end of the east structure. The "infill" area is currently a landscaped greenspace, and the east addition is grass-covered. We understand that the maximum column load for the two additions is estimated at 150 kips, with the maximum wall load at 7 kips per foot. We are not aware of any unusually high loads or tight settlement tolerances for the slabs-on-grade. The parking lot will be expanded southward

(adding 98 spaces with approximately 109,000 square feet of new pavement) as part of the project; the west half of this area is presently grass-covered while the east half is wooded. Some existing utilities will need to be rerouted around the new building footprints, including a catch basin in the "infill" area and drains into the detention basin in the east addition area. In the absence of a proposed grading plan, we have assumed minor (i.e., 2 feet or less) cuts and fills will be needed to achieve level building pads and grade pavement areas to drain. The east wall of the east addition appears to be located close to the edge of the existing detention basin's western embankment; deeper fills may be needed here if the basin's geometry will be modified as part of the project.

SUBSURFACE CONDITIONS

GCI mobilized a track-mounted drill rig (a CME45C with an automatic sampling hammer) to the site on April 10, 2023. On that day, our track rig was able to navigate the site without the assistance of a bulldozer. We drilled one standard penetration boring (B-1) in the proposed "infill" building area and six standard penetration borings (B-2 through B-7) within the planned two-story addition footprint to a depth of 25 feet below existing grade. We also drilled B-8 and B-9 within the proposed parking lot expansion area, B-9 as a standard penetration boring to a depth of 5.5 feet and B-8 (located in a currently wooded area) as a hand auger to a depth of 1.5 feet. We have attached boring logs, a boring location plan, and a summary table of encountered subsurface conditions in the appendix. We discuss the subsurface findings below. Please refer to the individual boring logs for more detailed subsurface information at specific boring locations.

Surface Cover

The seven building area borings, plus pavement B-9 encountered, existing fills that extended to depths ranging from 0.3 to 4 feet below the surface. The upper few inches of

the fill were typically re-spread topsoil and/or heavily stained lean clays. Deeper fills generally consisted of stained lean clays mixed with or interlayered with brown sandy lean clays. Standard penetration N-values recorded within the fills suggested medium stiff conditions, with soft to medium stiff soils found in B-4.

Hand auger pavement boring B-8, located in a wooded area, found 0.3 foot of topsoil surface cover, which appeared to be original (i.e., not re-spread), overlying natural soils.

Natural Soils

Below the existing fills, the borings encountered a cap of cohesive natural soils that we visually classified as a lean clay (CL in the Unified/ASTM Soils Classification System).

These site soils generally contained few sand, trace fine gravel, trace roots and exhibited moderately high plasticity. With the exception of B-5, the lean clays found in our borings were organically stained; such heavy staining is typically associated with water filtering down through the overlying topsoil as a result of repeated surface ponding over the years and is an indication of poorly draining soils. With depth, dark gray mottling and less staining were commonly noted in this stratum; thin layers of silt (ML) or silty fine sand (SM) also were encountered with depth in a few of the borings. Standard penetration N-values recorded in the stained lean clays generally indicated medium stiff cohesive consistencies. The stained lean clay persisted to depths ranging from 6 to 7 feet below existing grade at the building area boring locations and to a depth of 1.5 feet in parking boring B-9. Hand auger pavement boring B-8 was terminated in the stained lean clay at a depth of 1.5 feet below the surface.

In borings B-1, B-2, B-3, and B-5, the stained lean clay was underlain by a layer of granular soils at a depth of 6 or 7 feet below the surface. We visually classified the soil

as a brown poorly-graded sand with silt and gravel (SP-SM) or a silty sand (SM).

Thickness of the granular layer ranged from 1 to 6 feet at these boring locations. Limited standard penetration blow counts suggested medium dense to dense conditions.

Brown and/or gray glacial till formations were encountered with depth, either immediately below the stained lean clay or below the brown sand layer, at depths ranging from 1.5 to 12 feet below the surface at the boring locations. Till is a primarily cohesive soil deposited by a glacier that contains varying amounts of sand and gravel and generally exhibits moderate plasticity. We visually classified the site brown and gray glacial tills as sandy lean clays (CL). Cobbles and occasional thin to thick layers of silty sand (SM), silty sand with gravel (SM), and/or sandy silt (ML) were noted within this otherwise cohesive deposit in most of the borings. Some of these layers were thinly stratified. Standard penetration blow counts recorded in the brown and gray tills indicated stiff to hard cohesive consistencies, with a zone of medium stiff soils found in the upper portion of the brown till in B-3. Borings B-1, B-3, and B-6 were terminated within the gray glacial till formation at a depth of 25 feet below existing grade. B-9 was terminated within the brown till at a depth of 5.5 feet.

Thicker granular deposits were found below the gray till, at depths ranging 17 to 24 feet below existing grade, in borings B-2, B-4, B-5, and B-7. We visually classified the soils as gray silty sand with gravel (SM) to poorly-graded sand with silt and gravel (SP-SM). Blow counts indicated medium dense to dense conditions. Borings B-2 and B-5 were terminated within the poorly-graded sand at a depth of 25 feet below existing grade; B-4 and B-7 were terminated within a slightly plastic silty clay (CL-ML) layer found within the deposit.

Bedrock

We did not encounter bedrock within the depths of the borings (maximum drill depth of 25 feet). There is a water well located at the north end of the site that is registered with ODNR. The well log (see attached) indicates that this well was drilled through clays interlayered with sands and gravels; it was terminated within a sand and gravel deposit at a depth of 91 feet. The 1993 ODNR *Ground Water Resources of Darke County* publication maps the site as being underlain by permeable deposits of sand and gravel within buried valleys that are underlain by limestone and dolomite bedrock. Querying ODNR's online interactive karst map indicates depth to the top of rock is estimated to be at least 200 feet below the site.

Groundwater and Moisture Conditions

"Infill" addition area boring B-1 initially encountered water seepage at a depth of 13 feet, perched in a granular lens within the gray glacial till formation. In eastern addition borings B-2 through B-7, we observed groundwater at depths of 6 to 7 feet below the surface, at or near the bottom of the stained lean clay stratum. By the completion of drilling, the water level was recorded at a depth of 17 feet below the surface in the B-1 borehole and at depths ranging from 4 feet to 12 feet below existing grade in B-2 through B-7. Shallow pavement borings B-8 and B-9 were "dry" at the time of this study, with no free groundwater seepage observed in the boreholes during drilling, as well as upon completion of drilling operations.

We generally characterized the moisture of the fill and natural soils as moist to very moist, with very moist to wet soils associated with noted seepage zones and with the granular layers found within or below the more cohesive site deposits. The gray tills were typically moist. There is a potential for some of the thicker granular deposits to have a

hydraulic connection to Bridge Creek. Note that groundwater levels and soil moisture conditions can vary with changes in season, stabilization time, in response to precipitation events, and as a result of other factors that may differ from the time the borings were drilled.

LABORATORY TESTING

We performed a limited laboratory testing program that consisted of determining the organic and natural moisture contents of two samples of the stained natural lean clays and one sample of the underlying brown mottled dark gray lean clay. Stained lean clay split-spoon soil samples, one obtained from a depth of 4.0'-5.5' from boring B-7 and another from a depth of 2.0'-3.5' from B-3, were found to have respective organic contents of 5.4% and 4.1% using loss-on-ignition (L.O.I.) testing. The 4.0'-5.5' sample of the mottled dark gray/less stained lean clay obtained from B-3 was found to have an organic content of 2.8%. In our opinion, we consider organic contents in excess of 4% to be a consideration from a geotechnical viewpoint. The natural moisture contents of these three samples ranged from 23.6% to 25.0% at the time of this study.

ANALYSES AND CONCLUSIONS

GEOTECHNICAL EVALUATION

GCI is of the opinion that the medium stiff to stiff, non-organic natural cohesive site soils are suitable for the support of the proposed construction. In our opinion, the primary geotechnical concerns for the project are associated with the existing site development (e.g., the presence of existing fills of varying depth and consistency, existing utilities that will need to be rerouted, etc.), the presence of heavily stained and plastic natural lean clay soils below the fills, and site preparation issues. **We feel that remediation of the existing fills and the organically stained natural soils will be needed to obtain**

suitable support for the proposed construction. We discuss these and other geotechnical considerations in further detail in the following paragraphs.

Site Preparation

Any existing utilities that cross the proposed building footprints should be rerouted, with the old lines and associated backfill removed. Backfill with good quality structural fill that is placed in shallow lifts (per the recommendations later in the report), which are benched into the sides of the excavation and properly compacted. Old lines located outside proposed building areas may be abandoned in place, provided the ends are properly capped to avoid migration of fines.

Surface vegetation, topsoil, root mats, stumps from removed trees, and other organic materials should be stripped from below the proposed building footprints and pavement areas, plus a minimum of 10 feet laterally beyond the construction zone. Organically stained lean to fat clay soils (some fill, some natural) may be encountered; such soils should be undercut if judged to be organic or "fat" (highly plastic). Topsoil and the heavily stained and/or fat clays are not suitable for use as structural fill and should be stockpiled for later use in site landscaping or otherwise be hauled off-site.

Existing Fill

Our borings found existing fills, extending to depths ranging from 0.3 feet to 4 feet below existing grade. The composition of the fill mass generally consisted of stained lean clays mixed with or interlayered with brown sandy lean clays. We do not have any information from either of the prior building constructions, not any documentation with regard to placement of these old fills. We suspect that heavily stained lean clays were removed from below the existing building footprints during their construction and placed in current

addition areas. Some of the material may have been placed to form the west embankment of the existing detention basin. We also note the presence of the heavily stained natural lean clays below the fills. As detailed above, samples of the stained lean clay found in borings B-3 and B-7 were found to have organic contents of 4.1% and 5.4%, respectively, which we feel is high enough to be a consideration. In our opinion, the existing site fills and organic natural lean clays pose a total and differential settlement potential for the proposed additions, and we feel that remedial measures will be necessary, either in the form of removal and replacement of the problematic soils, in-situ fortification of these soils through the installation of rammed aggregate piers, or by extension of footings to stable, non-organic natural soils.

Option 1: Fill/Stained Soil Removal and Replacement - We recommend removing existing fills and stained natural soils that are judged to be organic and/or excessively soft or fat to expose natural non-organic soils from below the entire proposed building footprint (plus 10 feet laterally), carefully proof rolling to identify soft natural soils requiring additional undercuts or stabilization measures, and then placing controlled structural fill up to proposed subgrade elevation. Following this procedure, the proposed building can be supported on conventional shallow foundations bearing within the structural fill. This approach also would mitigate the potential for excessive slab settlement associated with the in-situ fills and stained natural soils.

Care must be taken to not undermine existing foundations when undercutting. This approach would be more difficult to implement under extended wet or cold weather conditions. We note that the heavily stained lean clays graded to less organic, dark gray mottled lean at depths of 3 to 4.5 feet below existing grade in some of the borings, with the brown sands or glacial tills encountered at depths of 6 to 7 feet (at 2.5 feet in B-5). The six eastern addition borings encountered water seepage at depths of 6 to 7 feet at the time of drilling, and dewatering may be needed. A layer of No. 2 stone could be "punched" into a soft/wet undercut subgrade as a bridge lift, if necessary.

The borings suggest that it will be necessary to import some of the structural fill material; we recommend that GCI observe the intended import material prior to its placement. While the removed non-organic existing fills would be suitable for re-use as structural fill, much of the removed materials will be organically stained and/or high plastic and will not be suitable for re-use in the building pad fills.

Option 2: Installation of Rammed Aggregate Piers (RAPs) -

RAPs, such as Geopiers, can be used to stiffen the existing in-situ soils below proposed foundations, provided they are properly designed and installed. These

design/build elements are installed by augering holes to a depth pre-determined by the designer, and then placing aggregate in lifts and ramming or vibrating the aggregate to displace and stiffen the surrounding soils. Depending on the element diameter and spacing, the allowable bearing pressure can be increased and settlements can be reduced. These are design/build elements which must be installed by certified contractors. The design/build contractor should verify the bearing capacity they are able to achieve and provide settlement estimates. Following this approach, conventional shallow foundations bearing on the RAPs can be used for support of the building. Slab support also can be improved by installation of RAPs below the entire building footprint, which we recommend.

Option 3: Extended Foundations – A third alternative is to extend all footings (including interior footings) through new and old fills, as well as organically stained natural soils, to bear on stable, non-organic natural soils. As the fills and stained lean clays encountered in our borings were less than 10 feet in depth, we expect that overexcavation with a trackhoe and backfill with a controlled density fill such as K-Krete up to design (frost code) bottom of footing elevations to be feasible. After bearing surfaces are approved, we recommend that overexcavations be backfilled with CDF up to design bottom of footing elevations. Perched water may be encountered at or near the depth of suitable bearing and may require the use of dewatering measures.

Care must be taken to not undermine existing foundations when overexcavating the new footings. Slab support remains an issue with this approach. Provided the client is willing to assume a risk of some settlement, GCI is of the opinion that the existing fills that are deeper than 24 inches below proposed slab subgrade elevation and are stable under a thorough proof-roll may be left in place. Organic or soft/loose zones detected by the proof-roll should be further undercut or stabilized.

Subgrade Stabilization

Once the site is properly stripped, the resultant exposed subgrades should be proof-rolled using a fully-loaded, tandem-axle dump truck (or equivalent) to identify potential soft, yielding subgrade areas. Soft spots identified during the proof-roll should be undercut to firm, stable conditions or otherwise stabilized prior to placing new structural fill, slab construction, or pavement aggregate base.

The stained lean clay site soils will pump excessively when wet. Stabilization of soft subgrades by disking, aerating/drying, and re-compaction may be feasible during traditionally drier times of the year. During wet seasons, partial undercutting and

replacing of wet soils with structural fill, drying with soil additives such as lime, or use of geosynthetics may be needed to create a stable subgrade before placing controlled fills. If the building pad and pavement subgrades will be exposed through typical seasonal wet or freezing weather conditions prior to concrete or asphalt placement, consideration could be made to chemically stabilizing the subgrades during earthwork procedures to enhance subgrade resilience and reduce undercuts and stone placement that may be needed where subgrades soften due to the inclement weather and repeated construction traffic. The use of soil additives such as lime, cement, and flyash or installation of geosynthetics should be reviewed by our office prior to use in the field. Careful routing of construction traffic is advised to help minimize instabilities of near surface soils during wet seasons.

Fill Placement and Compaction

Once subgrades are brought to a firm and stable condition (passing a final proof-roll), properly place and compact new structural fill within proposed building and pavement areas to achieve the required grades. Structural fill materials should be placed in maximum 8-inch thick loose lifts that are compacted to at least 98% of the maximum dry unit weight obtained from the Standard Proctor test. Cohesive soils will compact best with a sheepsfoot roller and granular soils will compact best with a vibratory smooth drum roller. The moisture in soils used as structural fill should be controlled to within $\pm 3\%$ of the Standard Proctor optimum moisture content. Depending on the time of year of earthwork, moisture adjustment of the site soils may be required to achieve proper compaction. Compaction will be difficult to obtain if soft/unstable subgrades are not properly remediated before starting to place fill or if the proposed fill materials contain excess moisture.

FOUNDATIONS

All footings should bear on firm and stable natural non-organic soils, on rammed aggregate piers, or on new, controlled fill placed directly over stable natural non-organic soils. Foundations bearing on acceptable soils can be designed using a maximum allowable bearing capacity not to exceed 3,000 pounds per square foot. Higher bearing capacities may be available if RAPs are installed. Regardless of the calculated values, we recommend minimum dimensions of 16 inches wide for wall footings and 30 inches square for isolated column pads to eliminate a potential punching effect. We recommend placement of longitudinal reinforcing steel within the bottoms of continuous footings to mitigate the effects of differential movements.

Depending on proposed grades, footings for the walls located adjacent to the detention basin may need to be lowered.

Exterior footings should be placed with a minimum soil cover equal to the local frost depth (anticipated at 36 inches) or to stable soils, whichever is deeper. Interior footings in heated areas may be placed as shallow as feasible if bearing on acceptable soils. If soft or unstable areas are encountered within footing excavations, undercut to stable soils. Undercut areas can be backfilled to bottom of footing elevation using a controlled density fill (CDF). Alternatively, the foundations can be constructed on firm, stable natural soils at the bottom of the undercut. GCI should be retained to observe soft or unstable bearing soils prior to undercuts.

Provided foundations are constructed in accordance with the recommendations of this report, potential total settlement should be 1" or less, while differential settlements should

be 0.5" or less. If RAPs are installed, the design/build contractor should verify the bearing capacity they are able to achieve and provide settlement estimates.

FLOOR SLAB

In our opinion, a concrete slab-on-grade may be used, provided the subgrade is thoroughly proof-rolled and any soft, yielding areas are brought to a stable condition prior to slab construction or placement of aggregate base. A "floating" slab design that would allow it to move independently in the vertical direction with respect to walls, columns, and footings, should be considered where existing fills and the stained lean clays are left in place (and not improved in situ through installation of RAPs below the slab area).

GCI recommends placing a minimum of 4 inches of granular fill (well-graded crushed stone, such as AASHTO #57 Stone or ODOT Item 304) under the slabs to serve as a capillary cut-off and to provide a uniform, firm subbase. The stone thickness should be increased to at least 6 inches below more heavily loaded slabs and to 8 inches (of #57 stone) under below-grade slabs. A modulus of subgrade reaction (k) of 150 p.c.i. can be used for design with the minimum 6-inch aggregate base. Chemical stabilization of a minimum 12-inch thick section of the subgrade would yield a higher subgrade modulus: 200 pci in conjunction with 6 inches of stone. These values correlate to a 1' by 1' plate load test and should be adjusted based on the actual loading area.

We recommend placement of a vapor retarder directly below the slab in areas where moisture may be a problem with slab-on-grade floor coverings or where slabs extend below grade.

SEISMIC FACTOR

Our borings revealed a generalized profile consisting of a few feet of existing fills overlying natural medium stiff to hard cohesive soils, including glacial tills, and medium dense to dense granular deposits. Depth to bedrock is estimated to be in excess of 200 feet below the surface at the site. Based on this information and in accordance with the provisions of Section 16 of the Ohio Building Code – Site class definitions, we estimate the site soil as Site Class D – “stiff soil profile.”

EXCAVATIONS

The borings did not encounter bedrock within their drill depths; as such, we do not anticipate bedrock will be encountered within site excavations. We anticipate that the natural and fill site soils can be excavated with conventional track hoe equipment. Excavation sidewalls that encounter granular fills or granular natural soils could be unstable, particularly if soils are saturated. Use of trench boxes or flatter than normal laybacks may be needed. **All site excavations should comply with current OSHA regulations.**

GROUNDWATER

We encountered water seepage in the six eastern building borings at depths of 6 to 7 feet, at or near the bottom of the stained/mottled dark gray lean clay stratum. We observed water seepage at a depth of 13 feet in “infill” building boring B-1, perched in a granular lens within the gray glacial till. As such, we anticipate that groundwater will pose some nuisance issues for shallow excavations at the site. If water is encountered in site excavations, the excavations should be dewatered to allow fill placement, footing construction, and utility trench backfilling in dry conditions. We expect groundwater

seepage flows can be handled with strategically placed portable sump pumps and working mats of crushed stone, as needed. Excavations that penetrate the thicker granular deposits below the site may encounter more substantial flows that could require the use of deep sumps or wellpoints. Contact GCI for additional recommendations if excessive groundwater conditions are encountered.

PAVEMENTS

Provided the site is properly prepared, conventional aggregate base and rigid/flexible pavements can be used. Prior to pavement construction, the subgrade should be carefully proof-rolled, and stabilized as necessary. Properly compacted, we feel that the unstained cohesive site soils would have a CBR value of at least 3.

A specific pavement design is beyond the scope of work of this report; GCI can provide one if requested. A site-specific pavement design would require additional laboratory testing and pavement use criteria. We assume that traffic will consist of automobiles and occasional trucks. Based on our experience with similar projects and soils, and assuming properly prepared subgrades, we recommend a minimum light-duty pavement section consisting of 3 inches of asphalt over 8 inches of aggregate base. For heavy-duty traffic areas, including the main traffic aisles and areas subjected to occasional refuse truck traffic and occasional truck deliveries, we suggest a pavement section consisting of a minimum of 4 inches of asphalt over 10 inches of aggregate base. We recommend a minimum of 8 inches of air-entrained, Portland cement concrete for the dumpster pad and the dumpster pad approach area.

Installation of a geogrid (Tensar Triax TX160, or equivalent) below the base aggregate course in areas subjected to stopping and turning traffic or concentrated traffic flow, such

as the main entrance/exit drives, will increase the structural number of the pavement section and improve the pavement performance. We also recommend placement of a geogrid in areas where old fills are left in place, as it may allow the pavement section to bridge over localized areas of differential settlement and thereby extend its life.

Providing adequate subbase drainage is critical to future pavement performance, particularly with near-surface soils consisting of moderately high plasticity, stained lean clay soils. Finger drains connecting to weep-holes in inlets, proper grading of pavement subgrades and surfaces to shed run-off, and underdrains in pavement swales are suggested subbase drainage methods and should be incorporated into the design by the site civil engineer.

SITE PREPARATION AND EARTHWORK

We provide below general guidelines for site preparation and earthwork operations.

1. Reroute existing or former utilities that cross the proposed building addition areas. Remove the old line(s) and associated trench backfill material. Properly backfill resulting excavations with compacted structural fill that is benched into the sides of the excavation. Old lines located outside proposed building areas may be abandoned in place, provided the ends are properly capped to avoid migration of fines.
2. Strip surface vegetation and topsoil from below the proposed building and pavement areas, plus a minimum of 10 feet laterally. Grub out tree roots and properly backfill stump holes. Topsoil and organic materials are not suitable for re-use as structural fill and should be stockpiled for redistribution in proposed green space areas and landscaping mounds or hauled off-site,
3. If the client has elected to use the remove/replace approach, remove existing fills and any stained natural soils judged to be organic from below the entire building footprint, plus 10 feet laterally. If the client has elected to leave existing fills and stained clays in place and extend foundations to stable non-organic natural soils – or install RAPs below the zone of influence of only the foundations - we recommend removing the existing fills to a minimum depth of 24 inches below the proposed slab subgrade elevation (based on the thickness of the existing pavement section found in our borings, additional undercuts may not be necessary to satisfy this requirement), proof-rolling the exposed subgrade and stabilizing as needed (or undercutting if judged to be organic), and replacing with structural fill to improve slab support.

Take care to not undermine existing foundations and slabs when undercutting.

Removed materials may be re-used as structural fill provided they are non-organic. We do not recommend that heavily stained lean clays be re-used as structural fills within the building pad.

4. Prior to new fill placement (including underslab gravel), thoroughly proof-roll the exposed subgrades with a fully-loaded, tandem-axle dump truck (or equivalent) to identify potential soft subgrade areas. Undercut soft areas or otherwise stabilize soft spots identified during the proof-roll prior to placing controlled fill, placing underslab aggregate, or proceeding with pavement construction. **Stabilization efforts will be dictated by the time of year that earthwork is performed, and clay-base soil subgrades will be problematic during wet seasons.** Carefully route construction vehicle traffic to avoid inducing subgrade instability.
5. Place controlled fills to design grade within the proposed building area, as required. Non-organic natural and removed fill soils (culled of any organics or other deleterious materials) are suitable for re-use as controlled fills. **Off-site borrow materials should be reviewed by our office prior to use.**

Place controlled fills in maximum 8-inch thick loose lifts and compact each lift to a minimum of 98% of the maximum Standard Proctor dry density (ASTM D-698) or 95% of the maximum Modified Proctor dry density (ASTM D-1557). The moisture in the fill soils should be controlled to within $\pm 3\%$ of the optimum Standard Proctor moisture content. **Depending on the time of year of earthwork, moisture adjustment of the site soils may be required to achieve proper compaction.** Cohesive soils will compact best with a sheepsfoot roller, while more granular material should be compacted with vibratory equipment. Lift thicknesses should be reduced to 6" in confined areas where hand operated compaction equipment is used.

6. Construct foundations and start building construction after the building pad is filled to grade. Acceptable bearing conditions are discussed in the *Geotechnical Evaluation* and *Foundations* sections of this report. A representative of GCI should observe footing excavations to verify that acceptable bearing conditions are being achieved. We recommend that overexcavations be backfilled with a controlled density fill such as K-Krete up to normal bottom of footing elevations, unless the structural engineer has approved forming foundations at the undercut depth.

Place concrete as soon as possible after bearing surfaces are approved. Excavations should be kept free of water and debris and should be protected from freezing.

7. Slab-on-grade and pavement subgrades should be compacted to a smooth and stable surface passing a proof-roll prior to the placement of aggregate base. Wet season construction may dictate the use of engineering geotextiles.
8. The earthwork, foundation, and concrete contractors should take necessary precautions when working during winter weather or when freezing temperatures may occur. Frozen materials should not be used in controlled fills, foundations should not be constructed over frozen soil, and concrete should be protected from freezing until

appropriate curing has occurred. Contact GCI for additional recommendations on cold-weather earthwork operations, if applicable.

CONSTRUCTION MATERIALS ENGINEERING AND TESTING

GCI provides construction materials engineering and testing services. For project continuity throughout construction, we recommend that GCI be retained to observe, test, and document:

- earthwork procedures (stripping, fill placement, compaction, utility trench backfill, etc.),
- slab preparation (proof-rolling, excavations, undercuts, etc.),
- concrete placement and compressive strength testing (footings, slabs, pavements, etc.), and
- structural steel (welds, bolts, etc.).

The purpose of this work is to assess that the intent of our recommendations is being followed and to make timely changes to our recommendations (as needed) in the event site conditions vary from those encountered in our borings. Please contact our field department to initiate these services.

FINAL

We recommend that GCI review the final site layout and grading plans. The recommendations contained in this report may be changed based on review of final site plans. If any changes in the nature, design, or locations of the construction are planned, conclusions and recommendations should not be considered valid unless verified in writing by GCI.

The recommendations contained in this report are the opinion of GCI based on the subsurface conditions found in the borings and available development information. It should be noted that the nature and extent of variations between borings might not become evident until construction. If variations then appear evident, it will be necessary

to re-evaluate the recommendations of this report. This report has been prepared for design purposes only and may not be sufficient to prepare an accurate bid document.

This report can be included in the Architect's Bidding Specifications.

If you have any questions or need for any additional information, please contact our office. It has been a pleasure to be of service to you on this project, and we hope to continue our services through construction.



GEOTECHNICAL
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APPENDIX – Proposed Family Health Facility Expansion – Greenville, Ohio

General Notes for Soil Sampling and Classifications
General Site Location Map (DeLorme)
2019 USGS Topographic Map Greenville West & East Quadrangles
1961 USGS Topographic Map Greenville West & East Quadrangles
USDA Soil Map
ODNR Water Well Location Map and Well Log
Site Location Map and Boring Location Plan
Summary of Encountered Subsurface Conditions
Test Boring Logs (B-1 to B-9)
Laboratory Test Results



GENERAL NOTES FOR SOIL SAMPLING AND CLASSIFICATIONS

BORINGS, SAMPLING AND GROUNDWATER OBSERVATIONS:

Drilling and sampling were conducted in accordance with procedures generally recognized and accepted as standard methods of exploration of subsurface conditions. The borings were drilled using a truck-mounted drill rig using auger boring methods with standard penetration testing performed in each boring at intervals ranging from 1.5 to 5.0 feet. The stratification lines on the logs represent the approximate boundary between soil types at that specific location and the transition may be gradual.

Water levels were measured at drill locations under conditions stated on the logs. This data has been reviewed and interpretations made in the text of the report. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time the measurements were made.

The Standard Penetration Test (ASTM-D-1586) is performed by driving a 2.0 inch O.D. split barrel sampler a distance of 18 inches utilizing a 140 pound hammer free falling 30 inches. The number of blows required to drive the sampler each 6 inches of penetration are recorded. The summation of the blows required to drive the sampler for the final 12 inches of penetration is termed the Standard Penetration Resistance (N). Soil density/consistency in terms of the N-value is as follows:

COHESIONLESS DENSITY		COHESIVE CONSISTENCY	
0-10	Loose	0-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
50 +	Very Dense	15-30	Very Stiff
		30 +	Hard

SOIL MOISTURE TERMS

Soil Samples obtained during the drilling process are visually characterized for moisture content as follows:

MOISTURE CONTENT	DESCRIPTION
Damp	Soil moisture is much drier than the Atterberg plastic limit (where soils are cohesive) and generally more than 3% below Standard Proctor "optimum" moisture conditions. Soils of this moisture generally require added moisture to achieve proper compaction.
Moist	Soil moisture is near the Atterberg plastic limit (cohesive soils) and generally within $\pm 3\%$ of the Standard Proctor "optimum" moisture content. Little to no moisture conditioning is anticipated to be required to achieve proper compaction and stable subgrades.
Very Moist	Soil moisture conditions are above the Atterberg plastic limit (cohesive soils) and generally greater than 3% above Standard Proctor "optimum" moisture conditions. Drying of the soils to near "optimum" conditions is anticipated to achieve proper compaction and stable subgrades.
Wet	Soils are saturated. Significant drying of soils is anticipated to achieve proper compaction and stable subgrades.

SOIL CLASSIFICATION PROCEDURE:

Soil samples obtained during the drilling process are preserved in plastic bags and visually classified in the laboratory. Select soil samples may be subjected to laboratory testing to determine natural moisture content, gradation, Atterberg limits and unit weight. Soil classifications on logs may be adjusted based on results of laboratory testing.

Soils are classified in accordance with the ASTM version of the Unified Soil Classification System. ASTM D-2487 "Classification of Soils for Engineering Purposes (Unified Soil Classification System) describes a system for classifying soils based on laboratory testing. ASTM D-2488 "Description and Identification of Soil (Visual-Manual Procedure) describes a system for classifying soils based on visual examination and manual tests.

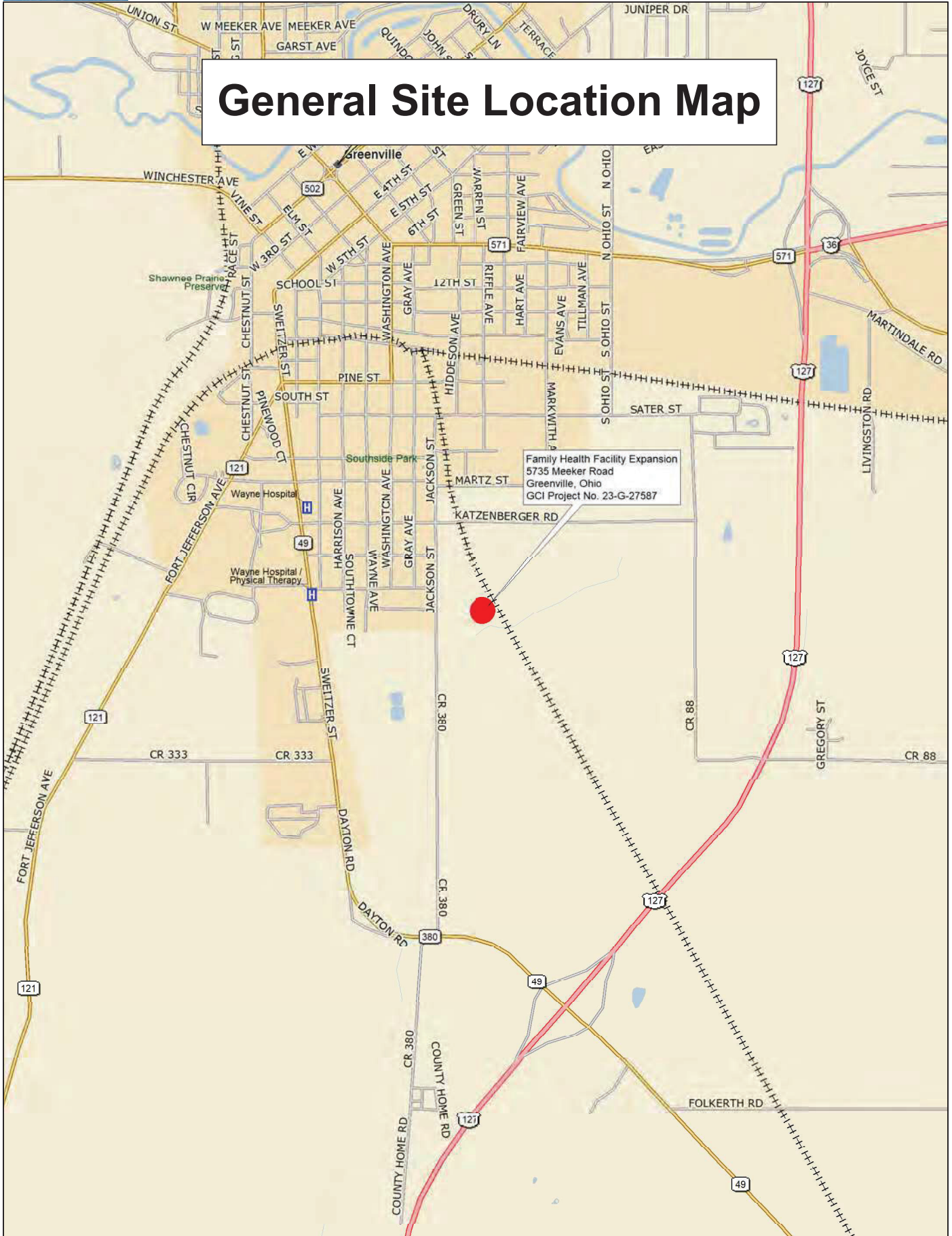
Soil classifications are based on the following tables (see reverse side):

GENERAL NOTES FOR SOIL SAMPLING AND CLASSIFICATIONS

PARTICLE SIZE DEFINITION		CONSTITUENT MODIFIERS	
Boulders:	>12"		
Cobbles:	3" to 12"	Trace	Less than 5%
Gravel:	Coarse: 3/4" to 3"	Few	5-10%
	Fine: No. 4 (3/16") to 3/4"	Little	15-25%
Sand:	Coarse No. 10 (2.0mm) to No. 4 (4.75mm)	Some	30-45%
	Medium No. 40 (0.425mm) to No. 10 (2.0mm)	Mostly	50-100%
	Fine No. 200 (0.074mm) to No. 40 (0.425mm)		
Silt & Clay	<0.074mm; classification based on overall plasticity; in general clay particles <0.005mm.		

ASTM/UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART		
COARSE-GRAINED SOILS (more than 50% of materials is larger than No. 200 sieve size)		
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	<i>Clean Gravel (less than 5% fines)</i>	
	GW	Well-graded gravel, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel sand mixtures, little or no fines
	<i>Gravels with fines (more than 12% fines)</i>	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
SANDS More than 50% of coarse fraction smaller than No. 4 sieve size	<i>Clean Sands (Less than 5% fines)</i>	
	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly-graded sands, gravelly sands, little or no fines
	<i>Sands with fines (More than 12% fines)</i>	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:		
Less than 5 percentGW, GP, SW, SP		
Greater than 12 percentGM, GC, SM, SC		
5 to 12 percentBorderline cases requiring dual symbols: SP-SM, GP-GM, etc.		
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size)		
SILTS AND CLAYS Liquid Limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	CL-ML	Inorganic silty clay of slight plasticity, P.I. between 4 and 7
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid Limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays or medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

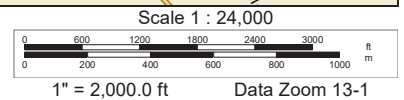
General Site Location Map

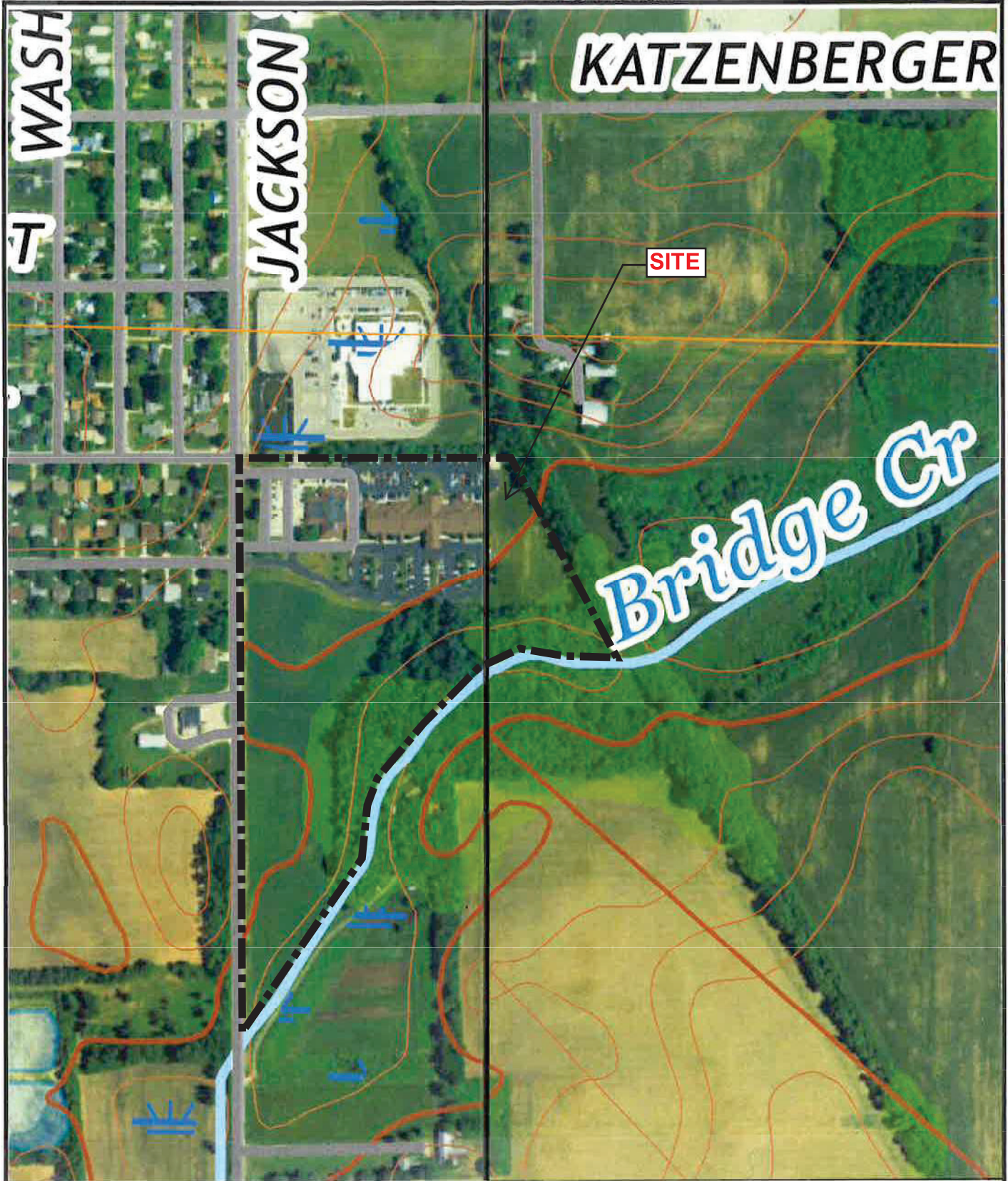


Data use subject to license.

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www.delorme.com

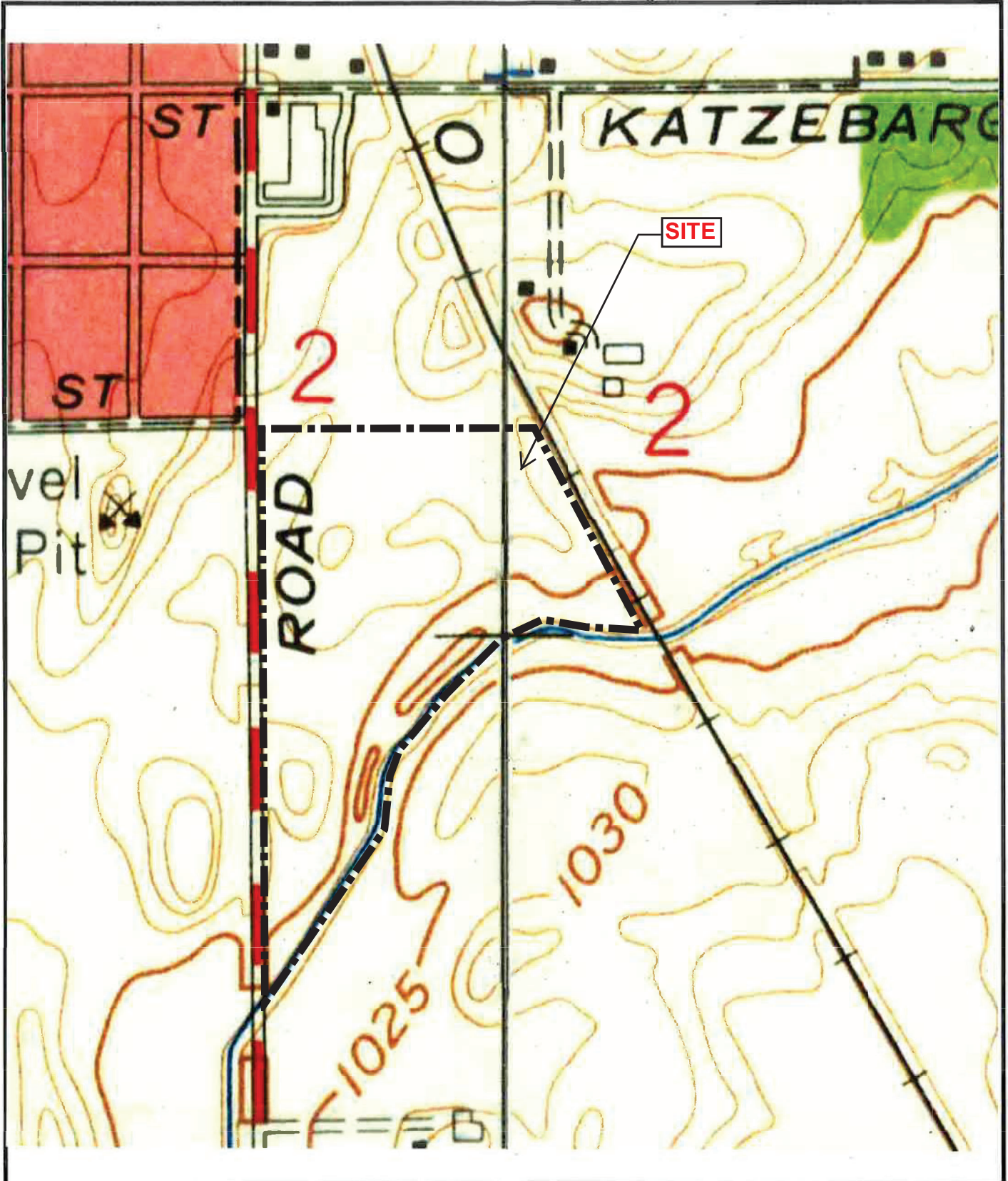




North

Proposed Family Health Facility Expansion
5735 Meeker Road
Greenville, Ohio
Scale: 1" = 400'±





Proposed Family Health Facility Expansion
5735 Meeker Road
Greenville, Ohio
Scale: 1" = 400'±



Soil Map—Darke County, Ohio
(Family Health Facility Expansion - Greenville, Ohio)



MAP LEGEND

- Area of Interest (AOI)
- Area of Interest (AOI)
- Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points
- Special Point Features**
 - Blowout
 - Borrow Pit
 - Clay Spot
 - Closed Depression
 - Gravel Pit
 - Gravelly Spot
 - Landfill
 - Lava Flow
 - Marsh or swamp
 - Mine or Quarry
 - Miscellaneous Water
 - Perennial Water
 - Rock Outcrop
 - Saline Spot
 - Sandy Spot
 - Severely Eroded Spot
 - Sinkhole
 - Slide or Slip
 - Sodic Spot
- Water Features**
 - Streams and Canals
- Transportation**
 - Rails
 - Interstate Highways
 - US Routes
 - Major Roads
 - Local Roads
- Background**
 - Aerial Photography
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Darke County, Ohio
Survey Area Data: Version 22, Sep 8, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 14, 2019—Oct 23, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
MmB	Miamian silt loam, 2 to 6 percent slopes	4.1	61.2%
Pa	Patton silty clay loam, 0 to 2 percent slopes	2.6	38.8%
Totals for Area of Interest		6.8	100.0%

ODNR Water Wells

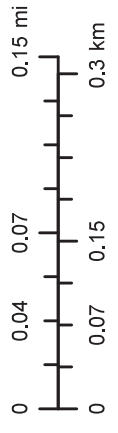
Family Health Facility Expansion - Meeker Road - Greenville



- Statewide Parcels
- Current Township
- Counties
- Well Logs

April 11, 2023

Scale: 1:6,771





WATER WELL LOG & DRILLING REPORT

Ohio Department of Natural Resources
Division of Geological Survey
Phone: 614-265-6740

Well Log Number: 1007777

Original Owner & Location

Original Owner Name: *BRUMBAUGH CONST*

County: *DARKE*

Address: *MEEKER RD*

City: *GREENVILLE*

Location Number: *0*

Latitude: *40.085*

Township: *GREENVILLE*

State: *OH*

Location Map Year:

Longitude: *-84.62556*

Section Number:

Zip Code:

Location Area:

Construction Details

Borehole Diameter 1: *10 in.*

Casing Diameter 1: *10 in.*

Casing Height Above Ground: *ft.*

Date of Completion: *05/01/2007*

Drilling Company Name: *BOONE WATER SYSTEMS INC*

Screen Diameter: *10 in.*

Type: *Continuous Wire Wound*

Set Between: *83 and 91 ft.*

Grout Material/Size: *Bentonite*

Method of Installation: *Pumped With Tremie Pipe*

Borehole Depth 1: *91 ft.*

Casing Length 1: *83 ft.*

Aquifer Type: *SAND & GRAVEL*

Total Depth: *91*

Slot Size: *0.05 in.*

Material: *Stainless Steel*

Vol/Wt Used: *175 LBS*

Placed: *0 to 91 ft.*

Depth to Bedrock: *0 ft.*

Casing Thickness 1: *0.375 in.*

Well Use: *HTG/COOLING*

Screen Length: *8 ft.*

Well Test Details

Static Water Level: *2 ft.*

Drawdown: *70 ft.*

Test Rate: *80 gpm*

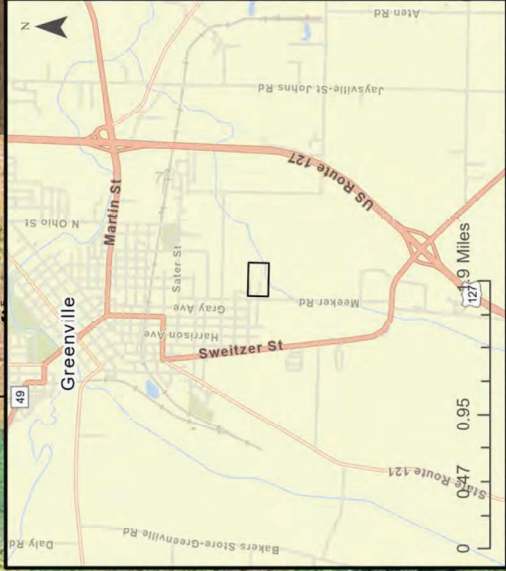
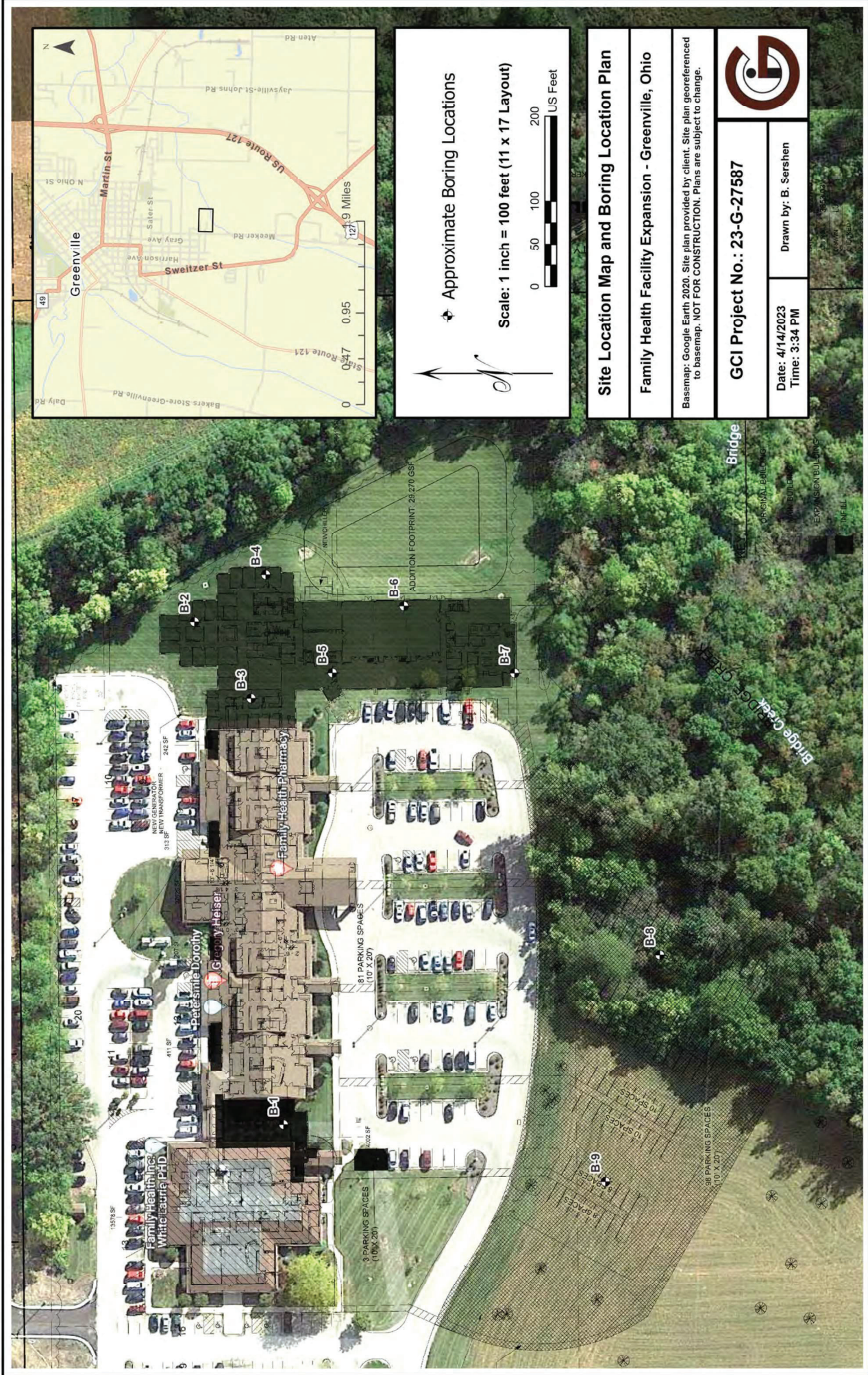
Test Duration: *2 hrs.*


Associated Documents:

Comments


Drilling Log

Formations:	From:	To:
TOP SOIL	0	3
CLAY	3	22
SAND/GRAVEL/CLAY	22	46
CLAY	46	69
SAND & GRAVEL	69	70
CLAY	70	78
SAND & GRAVEL	78	91




 Approximate Boring Locations

Scale: 1 inch = 100 feet (11 x 17 Layout)


 US Feet

Site Location Map and Boring Location Plan	
Family Health Facility Expansion - Greenville, Ohio	
<small>Basemap: Google Earth 2020. Site plan provided by client. Site plan georeferenced to basemap. NOT FOR CONSTRUCTION. Plans are subject to change.</small>	
GCI Project No.: 23-G-27587	
Date: 4/14/2023 Time: 3:34 PM	Drawn by: B. Sershen



TEST BORING LOG

PROJECT NAME Family Health Facility Expansion - 5735 Meeker Road - Greenville, Ohio BORING NO. B-1
 CLIENT Family Health Services of Darke County, Inc. PROJ. _____ SURF. ELEV. _____
 NO. 23-G-27587 DATE DRILLED 4/10/2023

GROUND WATER OBSERVATION				Proportions Used			140 lb Wt. x 30" fall on 2" O.D. Sampler				
<u>17.0</u> FEET BELOW SURFACE AT COMPLETION _____ FEET BELOW SURFACE AT 24 HOURS _____ FEET BELOW SURFACE AT _____ HOURS				Trace Less than 5% Few 5 to 10% Little 15 to 25% Some 30 to 45% Mostly 50 to 100%			Cohesionless Density 0 - 10 Loose 10 - 30 Medium Dense 30 - 50 Dense 50 + Very Dense		Cohesive Consistency 0 - 4 Soft 4 - 8 Medium Stiff 8 - 15 Stiff 15 - 30 Very Stiff 30 + Hard		
LOCATION OF BORING See Boring Location Plan											
DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness		
				0-6	6-12	12-18					
	1.25-2.5	0.0-1.5	SS	5	3	4	Moist	1.3	FILL: Stained Lean Clay and Brown Sandy Lean Clay with Gravel, Topsoil in upper portion		
	1.75-2.0	2.0-3.5	SS	4	4	4	Moist to Very Moist		Heavily Stained Brown Lean Clay (CL); moderately high plasticity, few sand, trace fine gravel		
	0.75-1.5	4.0-5.5	SS	4	3	4	Moist		dark gray mottling, less staining below 3.5'		
5								6.0	occasional thin layers of silt (ML) with depth		
	--	8.5-10.0	SS	10	14	18	Moist		Brown Poorly-Graded Sand with Silt and Gravel (SP-SM); fine to coarse sand, little to some gravel, few to little non-plastic silt		
10								12.0	cobbles		
	4.5	13.5-15.0	SS	10	16	20	Moist		Gray Sandy Lean Clay (CL) - glacial till; low to moderate plasticity, some sand, few to little gravel, trace quartz fragments Water Seepage at 13.0'		
15									cobbles		
									occasional layers of silty fine to medium sand (SM)		
	4.5	18.5-20.0	SS	16	25	30	Moist	19.0			
20								20.0	Gray Sandy Silt (ML); little fine to medium sand, non-plastic		
									Gray Sandy Lean Clay (CL) - glacial till; low to moderate plasticity, some fine to coarse sand, few to little gravel		
									occasional layers of silty sand with gravel (SM)		
	4.5	23.5-25.0	SS	15	24	31	Moist		cobbles		
								25.0	BOTTOM OF BORING: 25.0'		

* The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



TEST BORING LOG

PROJECT NAME Family Health Facility Expansion - 5735 Meeker Road - Greenville, Ohio BORING NO. B-2
 CLIENT Family Health Services of Darke County, Inc. PROJ. _____ SURF. ELEV. _____
 NO. 23-G-27587 DATE DRILLED 4/10/2023

GROUND WATER OBSERVATION				Proportions Used			140 lb Wt. x 30" fall on 2" O.D. Sampler					
<u>6.0</u> FEET BELOW SURFACE AT COMPLETION _____ FEET BELOW SURFACE AT 24 HOURS _____ FEET BELOW SURFACE AT _____ HOURS				Trace Less than 5% Few 5 to 10% Little 15 to 25% Some 30 to 45% Mostly 50 to 100%			Cohesionless Density 0 - 10 Loose 10 - 30 Medium Dense 30 - 50 Dense 50 + Very Dense		Cohesive Consistency 0 - 4 Soft 4 - 8 Medium Stiff 8 - 15 Stiff 15 - 30 Very Stiff 30 + Hard			
LOCATION OF BORING See Boring Location Plan												
DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness			
				0-6	6-12	12-18						
	2.0	0.0-1.5	SS	4	3	3	Moist	0.5	FILL: Topsoil and Stained Lean Clay			
									Heavily Stained Brown Lean Clay (CL); moderately high plasticity, few sand			
	1.25-1.75	2.0-3.5	SS	3	3	3	Moist					
5	0.5-1.25	4.0-5.5	SS	2	3	3	Moist to Very Moist		dark gray mottling, less staining below 4.5'			
								6.0	Water Seepage at 6.0'			
									Brown Poorly-Graded Sand with Silt and Gravel (SP-SM); fine to coarse sand, little to some gravel, few to little non-plastic silt			
	--	8.5-10.0	SS	6	12	5	Wet to Very Moist		with cobbles, layers of poorly-graded gravel (GP)			
10	0.75							9.5	Brown Sandy Lean Clay (CL) - glacial till; moderate plasticity, little to some fine to coarse sand, few gravel			
								12.0	Gray Sandy Lean Clay (CL) - glacial till; low to moderate plasticity, some fine to coarse sand, few to little gravel			
									occasional layers of silty sand with gravel (SM)			
15	2.0-3.5	13.5-15.0	SS	10	12	16	Moist to Very Moist					
	4.5	18.5-20.0	SS	13	20	23	Moist		cobbles			
20												
								22.0	Gray Silty Sand with Gravel (SM) to Poorly-Graded Sand with Silt and Gravel (SP-SM); fine to coarse sand, little to some fine to coarse gravel, few to little non-plastic silt			
	--	23.5-25.0	SS	6	8	12	Wet					
								25.0	BOTTOM OF BORING: 25.0'			

* The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



TEST BORING LOG

PROJECT NAME Family Health Facility Expansion - 5735 Meeker Road - Greenville, Ohio BORING NO. B-3
 CLIENT Family Health Services of Darke County, Inc. PROJ. _____ SURF. ELEV. _____
 NO. 23-G-27587 DATE DRILLED 4/10/2023

GROUND WATER OBSERVATION				Proportions Used			140 lb Wt. x 30" fall on 2" O.D. Sampler					
<u>7.0</u> FEET BELOW SURFACE AT COMPLETION _____ FEET BELOW SURFACE AT 24 HOURS _____ FEET BELOW SURFACE AT _____ HOURS				Trace Less than 5% Few 5 to 10% Little 15 to 25% Some 30 to 45% Mostly 50 to 100%			Cohesionless Density 0 - 10 Loose 10 - 30 Medium Dense 30 - 50 Dense 50 + Very Dense			Cohesive Consistency 0 - 4 Soft 4 - 8 Medium Stiff 8 - 15 Stiff 15 - 30 Very Stiff 30 + Hard		
LOCATION OF BORING See Boring Location Plan												
DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION			
				0-6	6-12	12-18			Remarks include color, type of soil, etc. Rock-color, type, condition, hardness			
	2.0	0.0-1.5	SS	2	3	3	Moist	1.5	FILL: Stained Lean Clay and Brown Sandy Lean Clay with Gravel, Topsoil in upper portion			
	0.75-1.75	2.0-3.5	SS	3	3	3	Moist		Heavily Stained Brown Lean Clay (CL); moderately high plasticity, few sand, trace fine gravel <i>Organic Content (L.O.I. Testing) of 2'-3.5' Sample = 4.1%</i>			
5	0.75-1.0	4.0-5.5	SS	3	4	3	Moist to Very Moist		dark gray mottling, less staining below 4.5' <i>Organic Content (L.O.I. Testing) of 4'-5.5' Sample = 2.8%</i>			
								7.0	Water Seepage at 7.0'			
								8.0	Brown Poorly-Graded Sand with Silt and Gravel (SP-SM); fine to coarse sand, little to some gravel, few to little non-plastic silt			
	1.5-2.0	8.5-10.0	SS	3	3	4	Wet to Very Moist		Gray Sandy Lean Clay (CL) - glacial till; low to moderate plasticity, some fine to coarse sand, few to little gravel			
10								12.0	Gray Silty Sand with Gravel (SM); fine to coarse sand, little to some gravel, little non-plastic to slightly plastic silt			
	3.0	13.5-15.0	SS	6	14	17	Wet to Very Moist		with layers of low plasticity silty clay (CL-ML), non-plastic silt (ML), silty fine to medium sand (SM), and sandy lean clay with gravel (CL)			
15								19.0	Gray Sandy Lean Clay (CL) - glacial till; low to moderate plasticity, some fine to coarse sand, few to little gravel			
	4.5	18.5-20.0	SS	10	10	15	Wet to Moist		occasional layers of silty sand (SM)			
20												
	4.5	23.5-25.0	SS	10	17	29	Moist					
								25.0	BOTTOM OF BORING: 25.0'			

* The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



TEST BORING LOG

PROJECT NAME Family Health Facility Expansion - 5735 Meeker Road - Greenville, Ohio BORING NO. B- 4

CLIENT Family Health Services of Darke County, Inc. PROJ. _____ SURF. ELEV. _____
 NO. 23-G-27587 DATE DRILLED 4/10/2023

GROUND WATER OBSERVATION <u>10.0</u> FEET BELOW SURFACE AT COMPLETION _____ FEET BELOW SURFACE AT 24 HOURS _____ FEET BELOW SURFACE AT _____ HOURS	Proportions Used Trace Less than 5% Few 5 to 10% Little 15 to 25% Some 30 to 45% Mostly 50 to 100%	140 lb Wt. x 30" fall on 2" O.D. Sampler <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Cohesionless Density</td> <td style="width: 33%;"></td> <td style="width: 33%;">Cohesive Consistency</td> </tr> <tr> <td>0 - 10 Loose</td> <td></td> <td>0 - 4 Soft</td> </tr> <tr> <td>10 - 30 Medium Dense</td> <td></td> <td>4 - 8 Medium Stiff</td> </tr> <tr> <td>30 - 50 Dense</td> <td></td> <td>8 - 15 Stiff</td> </tr> <tr> <td>50 + Very Dense</td> <td></td> <td>15 - 30 Very Stiff</td> </tr> <tr> <td></td> <td></td> <td>30 + Hard</td> </tr> </table>	Cohesionless Density		Cohesive Consistency	0 - 10 Loose		0 - 4 Soft	10 - 30 Medium Dense		4 - 8 Medium Stiff	30 - 50 Dense		8 - 15 Stiff	50 + Very Dense		15 - 30 Very Stiff			30 + Hard
Cohesionless Density		Cohesive Consistency																		
0 - 10 Loose		0 - 4 Soft																		
10 - 30 Medium Dense		4 - 8 Medium Stiff																		
30 - 50 Dense		8 - 15 Stiff																		
50 + Very Dense		15 - 30 Very Stiff																		
		30 + Hard																		

LOCATION OF BORING See Boring Location Plan

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
				0-6	6-12	12-18			
				1.25-1.75	0.0-1.5	SS			
0.75-1.5	2.0-3.5	SS	2	3	3	Moist to Very Moist	7.0	Heavily Stained to Brown Mottled Dark Gray Lean Clay (CL); moderately high plasticity, few sand, trace fine gravel	
1.0-1.75	4.0-5.5	SS	3	4	4	Moist to Very Moist	10.0	occasional thin layers of silty fine sand (SM) with depth Water Seepage at 6.0'	
3.25-4.5	8.5-10.0	SS	6	6	8	Moist	17.0	Brown Sandy Lean Clay (CL) - glacial till; moderate plasticity, little to some fine to coarse sand, few to little gravel, trace sandstone fragments	
4.5	13.5-15.0	SS	16	23	25	Moist to Damp	24.0	occasional layers of silty sand (SM)	
--	18.5-20.0	SS	17	20	23	Very Moist to Wet	25.0	Gray Sandy Lean Clay (CL) - glacial till; low to moderate plasticity, some fine to coarse sand, few to little gravel	
1.0	23.5-25.0	SS	15	23	30	Very Moist	25.0	occasional layers of silty sand (SM)	
BOTTOM OF BORING: 25.0'									

* The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



TEST BORING LOG

PROJECT NAME Family Health Facility Expansion - 5735 Meeker Road - Greenville, Ohio BORING NO. B-5

PROJ. _____ SURF. ELEV. _____

CLIENT Family Health Services of Darke County, Inc. NO. 23-G-27587 DATE DRILLED 4/10/2023

GROUND WATER OBSERVATION <u>7.0</u> FEET BELOW SURFACE AT COMPLETION _____ FEET BELOW SURFACE AT 24 HOURS _____ FEET BELOW SURFACE AT _____ HOURS	Proportions Used Trace Less than 5% Few 5 to 10% Little 15 to 25% Some 30 to 45% Mostly 50 to 100%	140 lb Wt. x 30" fall on 2" O.D. Sampler Cohesionless Density 0 - 10 Loose 10 - 30 Medium Dense 30 - 50 Dense 50 + Very Dense	Cohesive Consistency 0 - 4 Soft 4 - 8 Medium Stiff 8 - 15 Stiff 15 - 30 Very Stiff 30 + Hard
---	--	--	--

LOCATION OF BORING See Boring Location Plan

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
				0-6	6-12	12-18			
	1.0-3.0	0.0-1.5	SS	3	3	4	Moist		FILL: Brown Sandy Lean Clay. trace stone
	4.5	2.0-3.5	SS	4	4	4	Moist	2.5	Brown Sandy Lean Clay (CL) - glacial till; moderate plasticity, little to some fine to coarse sand, few to little gravel, trace sandstone fragments; slight light gray mottling cobbles
5	3.25	4.0-5.5	SS	4	5	6	Moist		
								7.0	Water Seepage at 7.0'
10	--	8.5-10.0	SS	10	10	15	Wet		Brown Silty Sand (SM); fine to medium sand, little to some non-plastic to slightly plastic silt with layers of fine sandy silt (ML)
								11.0	Gray Sandy Lean Clay (CL) - glacial till; low to moderate plasticity, some fine to coarse sand, few to little gravel occasional layers of silty sand (SM) and sandy silt (ML)
15	4.5	13.5-15.0	SS	7	10	13	Moist		
								19.0	
20	4.5	18.5-20.0	SS	13	13	20	Moist to Damp		Gray Silt (ML); slightly plastic, few to little fine sand
								20.0	Gray Sandy Lean Clay (CL) - glacial till; low to moderate plasticity, some fine to coarse sand, few to little gravel
								23.5	
25	4.5	23.5-25.0	SS	15	20	20	Damp to Moist		Gray Silt (ML); slightly plastic, few to little fine sand
								24.5	
								25.0	Gray Silty Sand (SM); few gravel, little non-plastic silt
BOTTOM OF BORING: 25.0'									

* The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



TEST BORING LOG

PROJECT NAME Family Health Facility Expansion - 5735 Meeker Road - Greenville, Ohio BORING NO. B-6
 CLIENT Family Health Services of Darke County, Inc. PROJ. _____ SURF. ELEV. _____
 NO. 23-G-27587 DATE DRILLED 4/10/2023

GROUND WATER OBSERVATION	Proportions Used	140 lb Wt. x 30" fall on 2" O.D. Sampler	
<u>12.0</u> FEET BELOW SURFACE AT COMPLETION	Trace Less than 5%	Cohesionless Density	Cohesive Consistency
_____ FEET BELOW SURFACE AT 24 HOURS	Few 5 to 10%	0 - 10 Loose	0 - 4 Soft
_____ FEET BELOW SURFACE AT _____ HOURS	Little 15 to 25%	10 - 30 Medium Dense	4 - 8 Medium Stiff
	Some 30 to 45%	30 - 50 Dense	8 - 15 Stiff
	Mostly 50 to 100%	50 + Very Dense	15 - 30 Very Stiff
			30 + Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Depth*		SOIL IDENTIFICATION						
				From	To	To				Remarks include color, type of soil, etc. Rock-color, type, condition, hardness						
				0-6	6-12	12-18										
	1.0-1.5	0.0-1.5	SS	4	4	4	Moist		FILL: Brown Sandy Lean Clay and Stained Lean Clay Topsoil in upper portion							
	1.75	2.0-3.5	SS	4	5	4	Moist	3.0								
	0.25-0.75	4.0-5.5	SS	3	3	3	Very Moist	6.0	Water Seepage at 6.0'							
5									6.0	with occasional thin layers of silty fine sand (SM)						
									9.0	Brown Sandy Lean Clay (CL) - glacial till; moderate plasticity, little to some fine to coarse sand, few gravel						
	0.25 4.0	8.5-10.0	SS	7	8	10	Very Moist to Moist	9.0	9.0	Gray Sandy Lean Clay (CL) - glacial till; low to moderate plasticity, some fine to coarse sand, few to little gravel						
10										occasional to frequent layers of silty sand (SM) and sandy silt (ML)						
	4.5	13.5-15.0	SS	8	10	10	Moist	18.5	18.5	Gray Sandy Silt (ML); non-plastic to slightly plastic, little to some fine sand						
	--	18.5-20.0	SS	15	15	20	Very Moist	20.0	20.0	Gray Sandy Lean Clay (CL) - glacial till; low to moderate plasticity, some fine to coarse sand, few to little gravel						
15										occasional to frequent layers of silty sand (SM) and sandy silt (ML)						
	4.0	23.5-25.0	SS	14	22	23	Wet to Moist	25.0	25.0	cobbles						
										BOTTOM OF BORING: 25.0'						

* The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



TEST BORING LOG

PROJECT NAME Family Health Facility Expansion - 5735 Meeker Road - Greenville, Ohio BORING NO. B- 7

PROJ. _____ SURF. ELEV. _____

CLIENT Family Health Services of Darke County, Inc. NO. 23-G-27587 DATE DRILLED 4/10/2023

GROUND WATER OBSERVATION	Proportions Used	140 lb Wt. x 30" fall on 2" O.D. Sampler	
<u>4.0</u> FEET BELOW SURFACE AT COMPLETION	Trace Less than 5%	Cohesionless Density	Cohesive Consistency
_____ FEET BELOW SURFACE AT 24 HOURS	Few 5 to 10%	0 - 10 Loose	0 - 4 Soft
_____ FEET BELOW SURFACE AT _____ HOURS	Little 15 to 25%	10 - 30 Medium Dense	4 - 8 Medium Stiff
	Some 30 to 45%	30 - 50 Dense	8 - 15 Stiff
	Mostly 50 to 100%	50 + Very Dense	15 - 30 Very Stiff
			30 + Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
				0-6	6-12	12-18			
	2.5	0.0-1.5	SS	3	3	2	Moist		FILL: Stained Lean Clay, trace gravel, roots
	<0.25	2.0-3.5	SS	2	2	4	Very Moist		less staining with depth
								4.0	
	2.5-4.5	4.0-5.5	SS	5	5	6	Moist		Heavily Stained Brown Lean Clay (CL); moderately high plasticity, few sand, trace fine gravel
5								6.0	<i>Organic Content (L.O.I. Testing) of 4'-5.5' Sample = 5.4%</i> Water Seepage at 6.0'
									Brown Sandy Lean Clay (CL) - glacial till; moderate plasticity, some fine to coarse sand, few to little gravel
									occasional layers of silty sand with gravel (SM)
								12.0	
	3.0-4.5	8.5-10.0	SS	6	10	12	Moist to Very Moist		
10									
	--	13.5-15.0	SS	15	16	16	Wet		
15									
	--	18.5-20.0	SS	16	20	20	Wet		
20									
	4.5	23.5-25.0	SS	19	20	25	Very Moist to Moist	24.0	
25								25.0	Gray Silty Clay (CL-ML); slightly plastic, few to little sand with layers of gray sandy lean clay with gravel (CL)
									BOTTOM OF BORING: 25.0'

* The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



TEST BORING LOG

PROJECT NAME Family Health Facility Expansion - 5735 Meeker Road - Greenville, Ohio BORING NO. B- 8
 CLIENT Family Health Services of Darke County, Inc. PROJ. _____ SURF. ELEV. _____
 NO. 23-G-27587 DATE DRILLED 4/10/2023

GROUND WATER OBSERVATION <u>None</u> FEET BELOW SURFACE AT COMPLETION _____ FEET BELOW SURFACE AT 24 HOURS _____ FEET BELOW SURFACE AT _____ HOURS	Proportions Used Trace Less than 5% Few 5 to 10% Little 15 to 25% Some 30 to 45% Mostly 50 to 100%	140 lb Wt. x 30" fall on 2" O.D. Sampler <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-right: 1px solid black;">Cohesionless Density</td> <td>Cohesive Consistency</td> </tr> <tr> <td style="border-right: 1px solid black;">0 - 10 Loose</td> <td>0 - 4 Soft</td> </tr> <tr> <td style="border-right: 1px solid black;">10 - 30 Medium Dense</td> <td>4 - 8 Medium Stiff</td> </tr> <tr> <td style="border-right: 1px solid black;">30 - 50 Dense</td> <td>8 - 15 Stiff</td> </tr> <tr> <td style="border-right: 1px solid black;">50 + Very Dense</td> <td>15 - 30 Very Stiff</td> </tr> <tr> <td></td> <td>30 + Hard</td> </tr> </table>	Cohesionless Density	Cohesive Consistency	0 - 10 Loose	0 - 4 Soft	10 - 30 Medium Dense	4 - 8 Medium Stiff	30 - 50 Dense	8 - 15 Stiff	50 + Very Dense	15 - 30 Very Stiff		30 + Hard
Cohesionless Density	Cohesive Consistency													
0 - 10 Loose	0 - 4 Soft													
10 - 30 Medium Dense	4 - 8 Medium Stiff													
30 - 50 Dense	8 - 15 Stiff													
50 + Very Dense	15 - 30 Very Stiff													
	30 + Hard													

LOCATION OF BORING See Boring Location Plan

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
				From	To	12-18			
				0-6	6-12	12-18			
		HAND					Moist	0.3	Topsoil
		AUGER ONLY						1.5	Heavily Stained Brown Lean Clay (CL); moderate high plasticity, few sand
5									
10									
15									
									BOTTOM OF HAND AUGER BORING: 1.5'

* The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



TEST BORING LOG

PROJECT NAME Family Health Facility Expansion - 5735 Meeker Road - Greenville, Ohio BORING NO. B-9
 CLIENT Family Health Services of Darke County, Inc. PROJ. _____ SURF. ELEV. _____
 NO. 23-G-27587 DATE DRILLED 4/10/2023

GROUND WATER OBSERVATION <u>None</u> FEET BELOW SURFACE AT COMPLETION _____ FEET BELOW SURFACE AT 24 HOURS _____ FEET BELOW SURFACE AT _____ HOURS	Proportions Used Trace Less than 5% Few 5 to 10% Little 15 to 25% Some 30 to 45% Mostly 50 to 100%	140 lb Wt. x 30" fall on 2" O.D. Sampler <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Cohesionless Density</td> <td style="width: 33%;"></td> <td style="width: 33%;"></td> </tr> <tr> <td>0 - 10</td> <td>Loose</td> <td>0 - 4</td> </tr> <tr> <td>10 - 30</td> <td>Medium Dense</td> <td>4 - 8</td> </tr> <tr> <td>30 - 50</td> <td>Dense</td> <td>8 - 15</td> </tr> <tr> <td>50 +</td> <td>Very Dense</td> <td>15 - 30</td> </tr> <tr> <td></td> <td></td> <td>30 +</td> </tr> </table> Cohesive Consistency Soft Medium Stiff Stiff Very Stiff Hard	Cohesionless Density			0 - 10	Loose	0 - 4	10 - 30	Medium Dense	4 - 8	30 - 50	Dense	8 - 15	50 +	Very Dense	15 - 30			30 +
Cohesionless Density																				
0 - 10	Loose	0 - 4																		
10 - 30	Medium Dense	4 - 8																		
30 - 50	Dense	8 - 15																		
50 +	Very Dense	15 - 30																		
		30 +																		

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Depth*		SOIL IDENTIFICATION					
				From	To	To				Remarks include color, type of soil, etc. Rock-color, type, condition, hardness					
				0-6	6-12	12-18									
	0.75	0.0-1.5	SS	5	7	5	Moist	0.3	X	FILL: Topsoil					
								1.5	X	Stained Brown Lean Clay (CL); moderately high plasticity, few sand, trace fine gravel					
	4.5	2.0-3.5	SS	7	10	10	Moist		X	Brown Sandy Lean Clay (CL) - glacial till; moderate plasticity, little to some fine to coarse sand, trace to few gravel, trace sandstone fragments, cobbles					
									X	occasional layers of silty sand (CL)					
	4.0	4.0-5.5	SS	10	5	10	Moist		X	cobbles					
5								5.5	X						

										BOTTOM OF BORING: 5.5'					
10															
15															

* The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



Summary of Laboratory Results

Family Health Facility Expansion
5735 Meeker Road - Greenville, Ohio
GCI Job Number: 23-G-27587

Test Hole	Depth	Water Content (%)	Organic Content (%)
B- 3	2.0	24.6	4.1
B- 3	4.0	25.0	2.8
B- 7	4.0	23.6	5.4

April 2023

Sheet 1 of 1





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June 8, 2023

Mr. Jared Pollick, Executive Director
Family Health Services of Darke County, Inc.
5735 Meeker Road
Greenville, Ohio 45331

**Reference: Review of Proposed Grading Plan – Addendum Letter to
Subsurface Exploration and Geotechnical Engineering Report
Proposed Family Health Facility Expansion
5735 Meeker Road - Greenville, Ohio
GCI Project No. 23-G-27587**

Dear Mr. Pollick:

GCI performed a subsurface study for the referenced project and issued a geotechnical engineering report dated April 19, 2023. As stated in that report, GCI was of the opinion that the medium stiff to stiff unstained natural cohesive site soils and the medium dense to dense natural granular soils are suitable for the support of the proposed construction. In our opinion, the primary geotechnical concerns for the project were associated with the existing site development (e.g., the presence of existing fills of varying depth and consistency, existing utilities that will need to be rerouted, etc.), the presence of heavily stained and plastic natural lean clay soils below the fills, and site preparation issues. The proposed project consists of additions to existing buildings; as such, settlements experienced by the new construction will present as differential to the existing structures that have been in place for 15+ years. In our opinion, **remediation of the existing fills as well as the organically stained natural soils is needed to obtain suitable support for the proposed construction**, and we offered the following 3 options in our report:

1. remove/replace the existing fills and highly stained natural lean clays;
2. install rammed aggregate piers (RAPs) below foundations and possibly slabs; or
3. extend all foundations to stable natural, non-organic soils, backfilling the undercut with controlled density fill (CDF) up to design bottom of footing elevation.

GCI also attended a meeting (via zoom) with Maria Schertler and Todd Gindelberger of App Architecture on 5/22/2023.

Topographic and grading information for the project were not available at the writing of our report or at the time of the zoom meeting. App Architecture has since provided us with:

- A copy of the geotechnical report for the original free-standing building addition, prepared by CTL Engineering, Inc. and dated 5/23/2006; and
- A set of civil drawings for the project dated 5/17/23, which included a proposed demolition plan and a grading plan (see attached copies).

The purpose of this letter is to document recommendations made in the referenced zoom meeting, as well as to provide additional comments and to modify some of our recommendations after reviewing the new information.

The provided grading plan shows the finish floor (FF) elevation of both existing buildings is at about El. 1029.7 feet. The provided CTL report indicates two of the tested soil samples had 4% or higher organics, including one from a boring in the currently proposed addition area. Foundations for the 2006 free-standing addition were designed for an allowable bearing of 1,500 pounds per square foot. Ms. Schertler indicated that she is not aware of settlement issues with the existing construction. We understand that there is a small basement at the north end of the east building, and groundwater was problematic in this area in the past. We do not know the exact location of the basement, but App Architecture indicated that the slab and foundation loads from the planned additions would not add loads to the existing basement walls.

The FF of the additions will match that of the existing structures. Present grades in the large addition footprint range from about El. 1029 feet in northwest corner to about El. 1024 feet at the south end (and to El. 1022 feet at south end of the drop-off canopy area). As such, fill placements on the order of 1 to 6 feet will be needed to construct a level building pad. We also note that fills will be required over much of the planned the south parking lot expansion, with up to 6 feet of fill placements needed at the east end near the creek.

The existing stormwater detention basin at the east end of the property is being moved southward and slightly reconfigured as part of the project. The new pond will be about 1 foot deeper (bottom El. of 1020 feet), and the west embankment will be up to 3' higher on (El. 1029 feet). The pond embankments will be at a 5H:1V slope. Cuts will be needed at the south end of the pond, with fills required at the north end as well as along portions of the western embankment. A second small storm basin is planned within a currently wooded area south of the parking lot expansion, but we note it will only be about 2 feet deep and will mostly be formed from fills rather than cuts.

There are multiple storm lines (ranging from 12" to 24" in diameter with inverts commonly at about 6 to 6.5 feet below existing grades) that need to be rerouted around the large addition, as well as two manholes and two headwalls that will be removed. There also is a catch basin and storm line that must be removed in the larger "infill" area between two existing buildings.

We do not know if there is a planned on-site borrow pit or if structural material will need to be imported. We do not recommend using the heavily stained site clays in building pad fills, unless rammed aggregate piers are installed. The stained clays may be placed in deeper fills below proposed pavement areas, in the northern embankment of the reconfigured existing detention pond, or in the embankment for the new small south pond. We note that the near surface highly stained clays are relatively plastic and could be problematic below pavement areas due to stability concerns. Such soils will pump excessively when high in moisture. We do not recommend that earthwork operations be performed during extended wet or cold weather conditions.

There are four "lean-to" infill areas planned along north end of existing building. Review of the demolition plans show only landscaping areas need to be removed from these locations; i.e., there are no utilities. We understand that these "lean-tos" will be one story,

slab-on-grade, lightly loaded structures. During the zoom meeting, App Architecture asked if grade-beam foundations bearing at normal design depth could be considered for support of these four “lean-to” additions. While GCI still favors our original recommendation of extending foundations to bear in stable, non-organic natural soils, we feel this option could be considered, **provided the client is willing to accept a risk of settlement**. The grade beams should be designed with sufficient top and bottom steel to free-span 10 lineal feet under the imposed wall loads. The purpose of the grade beam is to provide a more rigid element against which to jack should future movements occur.

During the zoom meeting, we recommended that footings for the larger infill area between the two buildings and in the large eastern addition be undercut through the old fill and highly stained near surface lean clays during the zoom meeting. Our laboratory testing indicated the underlying mottled lean clays has less than 4% organics, and GCI was of the opinion that the footings could bear on the mottled clays if judged to be stable. Based on our review of the existing and proposed grades, however, we believe this approach may no longer be feasible for the large addition. While our boring logs suggest that suitable bearing may be available at elevations ranging from about El. 1024.5 feet to El. 1021 feet over much of the addition footprint, we express concern that footings at the south end may need to extend below El. 1019 feet (down to El. 1018 feet at boring B-7). **Undercuts that extend in excess of 10 feet below the surface may not be economically feasible as they would require the use of a large track hoe, may be subject to increased sloughing and require large amounts of CDF backfill, and are generally not practical below interior columns and thickened slabs.** Additionally, borings B-4 and B-7 encountered groundwater at or near the probably undercut elevation, indicating dewatering measures will be needed. **As such, GCI no longer recommends the extended foundation approach for the large addition area.** We now recommend that either the old fills and unsuitable natural soils be removed and replaced with structural fill or RAPs be installed. We note that the required rerouting of the existing utilities near the northeast and southeast portions of the large addition will result in old fills being removed and replaced in those areas; we suggest continuing the remove/replace across the building pad if an economic source of structural fill is available and access to the existing facilities would not be detrimentally impacted. Installation of RAPs would have the advantage of relatively rapid installation as well as allowing the stained lean clays to be placed as fill (if RAPs installed are below slab areas), but would carry the cost of mobilizing the equipment.

We also note the CTL study included a boring D-1, which was drilled in a possible borrow pit area located south of the current parking lot and within the currently planned parking lot expansion. If such a pit was actually excavated as part of the earlier construction, topsoil or other deleterious material may have been used to backfill it, which would not be considered suitable for pavement support. Contact GCI for additional recommendations if such an old borrow pit is encountered.

Other recommendations made in our geotechnical report remain valid. Please attach this letter report as an addendum to that document.

Respectfully submitted,
Geotechnical Consultants, Inc.

Gina M. Hawk

Gina M. Hawk, P.E.
Senior Project Engineer



Todd R. Meek

Todd R. Meek, P.E. LEED AP
In-House Reviewer

Distribution: Jared Pollick @ Family Health Services of Darke County – PDF via email
Maria Schertler & Todd Gindelberger @ App Architecture – PDF via email
GCI File 23-G-27587

Attachment: Demolition Plan C2.0
Grading and Drainage Plan C3.0 & C3.1

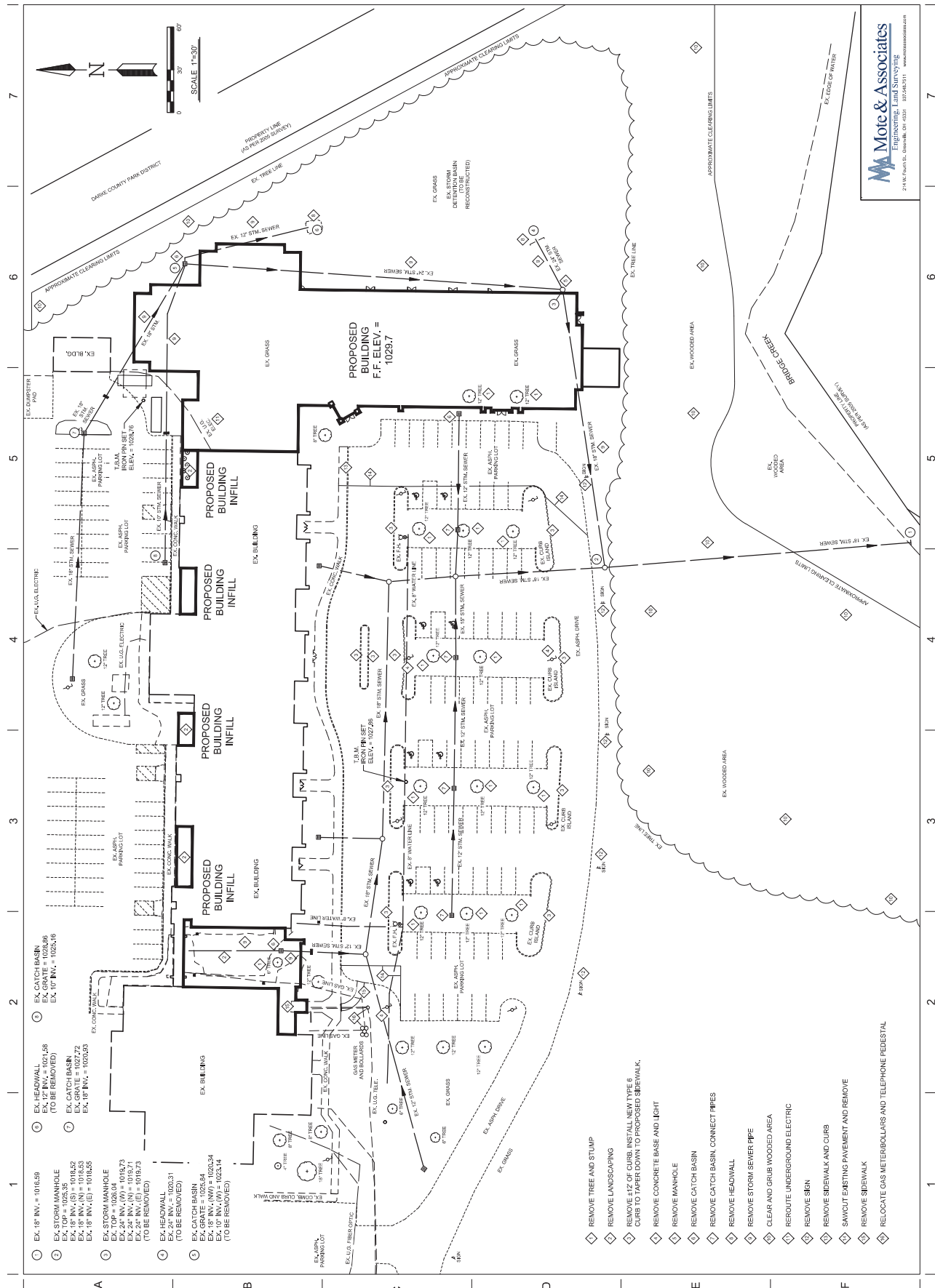
FACILITY RENOVATION
 FAMILY HEALTH

5735 MEEKER ROAD, GREENVILLE, OH 45331

NO.	DATE	DESCRIPTION

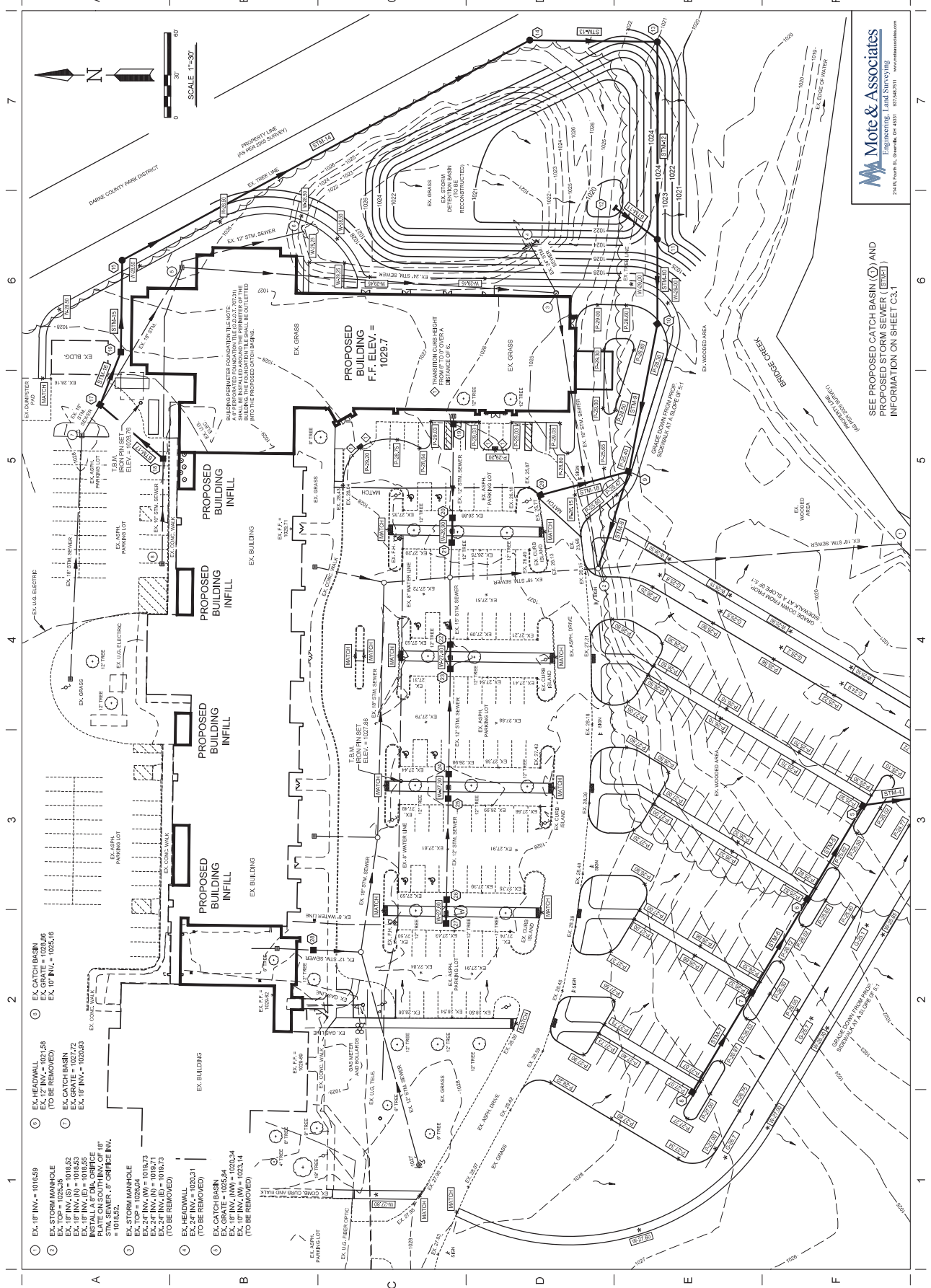
DATE	05/17/23
JOB NO.	3853.03
DRAWN	TJB
CHECKED	JLM
COMPILED	JLM
TITLE	DEMOLITION PLAN

SHEET NO.
C2.0



- 1 EX. 18" INV. = 1016.59
- 2 EX. CATCH BASIN
EX. GRATE = 1026.96
EX. 10" INV. = 1025.16
- 3 EX. STORM MANHOLE
EX. 12" INV. = 1021.58
(TO BE REMOVED)
- 4 EX. CATCH BASIN
EX. 18" INV. (N) = 1018.52
EX. 18" INV. (S) = 1018.52
EX. 18" INV. (E) = 1018.55
EX. 18" INV. (W) = 1020.00
- 5 EX. STORM MANHOLE
EX. TOP = 1026.04
EX. 18" INV. (N) = 1019.72
EX. 24" INV. (E) = 1019.73
EX. 24" INV. (W) = 1019.73
(TO BE REMOVED)
- 6 EX. HEADWALL
(TO BE REMOVED)
- 7 EX. 12" WATER LINE
- 8 EX. 18" INV. = 1021.58
EX. 18" INV. (NW) = 1020.34
EX. 10" INV. (W) = 1023.14
(TO BE REMOVED)

- 1 REMOVE TREE AND STUMP
- 2 REMOVE LANDSCAPING
- 3 REMOVE 4" OF CURB. INSTALL NEW TYPE 6 CURB TO TAPER DOWN TO PROPOSED SIDEWALK.
- 4 REMOVE CONCRETE BASE AND LIGHT
- 5 REMOVE MANHOLE
- 6 REMOVE CATCH BASIN
- 7 REMOVE CATCH BASIN, CONNECT PIPES
- 8 REMOVE HEADWALL
- 9 REMOVE STORM SEWER PIPE
- 10 CLEAR AND GRUB WOODED AREA
- 11 REROUTE UNDERGROUND ELECTRIC
- 12 REMOVE SIGN
- 13 REMOVE SIDEWALK AND CURB
- 14 SAWCUT EXISTING PAVEMENT AND REMOVE
- 15 REMOVE SIDEWALK
- 16 RELOCATE GAS METERBOLLARS AND TELEPHONE PEDESTAL



- 1 EX. 18" RW = 1016.59
- 2 EX. 12" RW = 1021.58 (TO BE REMOVED)
- 3 EX. 18" RW (S) = 1018.52
- 4 EX. 18" RW (W) = 1018.53
- 5 EX. 18" RW (E) = 1020.03
- 6 EX. 18" RW (N) = 1020.03
- 7 EX. 18" RW (S) = 1018.52
- 8 EX. 18" RW (W) = 1018.53
- 9 EX. 18" RW (E) = 1020.03
- 10 EX. 18" RW (N) = 1020.03
- 11 EX. 18" RW (S) = 1018.52
- 12 EX. 18" RW (W) = 1018.53
- 13 EX. 18" RW (E) = 1020.03
- 14 EX. 18" RW (N) = 1020.03
- 15 EX. 18" RW (S) = 1018.52
- 16 EX. 18" RW (W) = 1018.53
- 17 EX. 18" RW (E) = 1020.03
- 18 EX. 18" RW (N) = 1020.03
- 19 EX. 18" RW (S) = 1018.52
- 20 EX. 18" RW (W) = 1018.53
- 21 EX. 18" RW (E) = 1020.03
- 22 EX. 18" RW (N) = 1020.03
- 23 EX. 18" RW (S) = 1018.52
- 24 EX. 18" RW (W) = 1018.53
- 25 EX. 18" RW (E) = 1020.03
- 26 EX. 18" RW (N) = 1020.03
- 27 EX. 18" RW (S) = 1018.52
- 28 EX. 18" RW (W) = 1018.53
- 29 EX. 18" RW (E) = 1020.03
- 30 EX. 18" RW (N) = 1020.03
- 31 EX. 18" RW (S) = 1018.52
- 32 EX. 18" RW (W) = 1018.53
- 33 EX. 18" RW (E) = 1020.03
- 34 EX. 18" RW (N) = 1020.03
- 35 EX. 18" RW (S) = 1018.52
- 36 EX. 18" RW (W) = 1018.53
- 37 EX. 18" RW (E) = 1020.03
- 38 EX. 18" RW (N) = 1020.03
- 39 EX. 18" RW (S) = 1018.52
- 40 EX. 18" RW (W) = 1018.53
- 41 EX. 18" RW (E) = 1020.03
- 42 EX. 18" RW (N) = 1020.03
- 43 EX. 18" RW (S) = 1018.52
- 44 EX. 18" RW (W) = 1018.53
- 45 EX. 18" RW (E) = 1020.03
- 46 EX. 18" RW (N) = 1020.03
- 47 EX. 18" RW (S) = 1018.52
- 48 EX. 18" RW (W) = 1018.53
- 49 EX. 18" RW (E) = 1020.03
- 50 EX. 18" RW (N) = 1020.03

M/A Mote & Associates
 Engineering, Land Surveying
 2410 South St., Greenville, OH 45331 937.646.3711 www.moteland.com

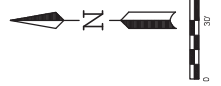
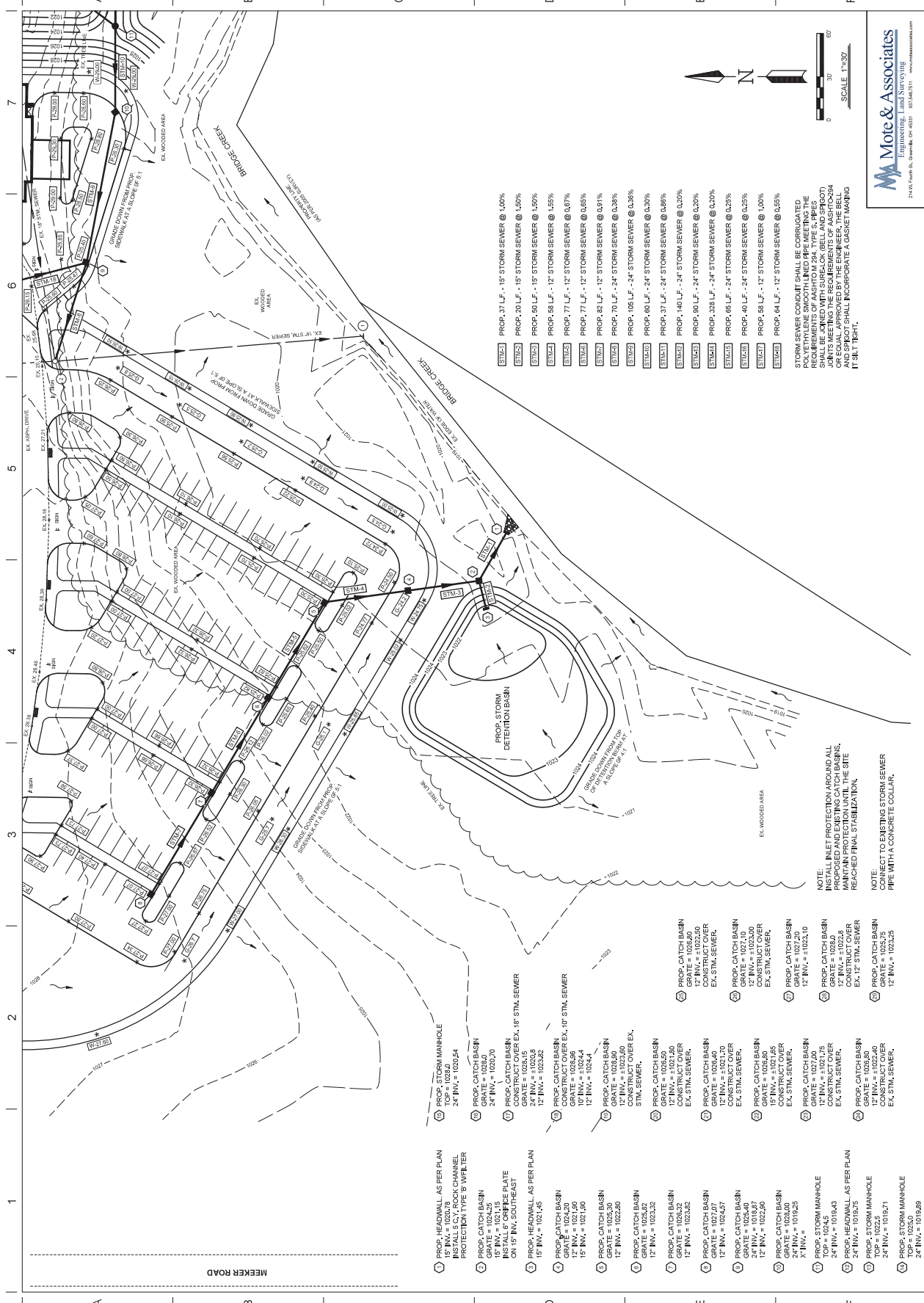
SEE PROPOSED CATCH BASIN (C) AND PROPOSED STORM SEWER (S) INFORMATION ON SHEET C3.1

FAMILY HEALTH
 FACILITY RENOVATION

NO.	DATE	DESCRIPTION
5735	MEEKER ROAD, GREENVILLE, OH 45331	

DATE	05/17/23
JOB NO.	3853.03
DRAWN	TJB
CHECKED	JLM
DATE	05/17/23

GRAVING AND DRAINAGE PLAN	
SHEET NO.	C3.1



- STW21 PROP. 37\"/>
- STW22 PROP. 20\"/>
- STW23 PROP. 50\"/>
- STW24 PROP. 58\"/>
- STW25 PROP. 77\"/>
- STW26 PROP. 82\"/>
- STW27 PROP. 70\"/>
- STW28 PROP. 105\"/>
- STW29 PROP. 60\"/>
- STW30 PROP. 37\"/>
- STW31 PROP. 140\"/>
- STW32 PROP. 90\"/>
- STW33 PROP. 108\"/>
- STW34 PROP. 40\"/>
- STW35 PROP. 58\"/>
- STW36 PROP. 64\"/>

NOTE: ALL 18\"/>

NOTE: CONNECT TO EXISTING STORM SEWER PIPE WITH A CONCRETE COLLAR.

- 1 PROP. HEADWALL AS PER PLAN
15\"/>
- 2 PROP. CATCH BASIN
GRATE = 1024.25
24\"/>
- 3 PROP. HEADWALL AS PER PLAN
INSTALL 6\"/>
- 4 PROP. CATCH BASIN
GRATE = 1024.20
15\"/>
- 5 PROP. CATCH BASIN
GRATE = 1025.20
12\"/>
- 6 PROP. CATCH BASIN
GRATE = 1025.32
12\"/>
- 7 PROP. CATCH BASIN
GRATE = 1025.32
12\"/>
- 8 PROP. CATCH BASIN
GRATE = 1027.07
12\"/>
- 9 PROP. CATCH BASIN
GRATE = 1028.07
12\"/>
- 10 PROP. CATCH BASIN
GRATE = 1028.00
24\"/>
- 11 PROP. STORM MANHOLE
X INV. = 1018.25
24\"/>
- 12 PROP. STORM MANHOLE
24\"/>
- 13 PROP. HEADWALL AS PER PLAN
24\"/>
- 14 PROP. CATCH BASIN
GRATE = 1028.25
24\"/>
- 15 PROP. STORM MANHOLE
TOP = 1025.25
24\"/>
- 16 PROP. STORM MANHOLE
24\"/>

- 17 PROP. CATCH BASIN
GRATE = 1028.00
CONSTRUCT OVER EX. STM. SEWER.
- 18 PROP. CATCH BASIN
GRATE = 1021.00
CONSTRUCT OVER EX. STM. SEWER.
- 19 PROP. CATCH BASIN
GRATE = 1027.20
CONSTRUCT OVER EX. STM. SEWER.
- 20 PROP. CATCH BASIN
GRATE = 1028.10
CONSTRUCT OVER EX. STM. SEWER.
- 21 PROP. CATCH BASIN
GRATE = 1028.10
CONSTRUCT OVER EX. STM. SEWER.
- 22 PROP. CATCH BASIN
GRATE = 1028.10
CONSTRUCT OVER EX. STM. SEWER.
- 23 PROP. CATCH BASIN
GRATE = 1028.10
CONSTRUCT OVER EX. STM. SEWER.

- 24 PROP. CATCH BASIN
GRATE = 1023.60
CONSTRUCT OVER EX. STM. SEWER.
- 25 PROP. CATCH BASIN
GRATE = 1023.60
CONSTRUCT OVER EX. STM. SEWER.
- 26 PROP. CATCH BASIN
GRATE = 1024.44
CONSTRUCT OVER EX. STM. SEWER.
- 27 PROP. CATCH BASIN
GRATE = 1025.60
CONSTRUCT OVER EX. STM. SEWER.
- 28 PROP. CATCH BASIN
GRATE = 1025.60
CONSTRUCT OVER EX. STM. SEWER.
- 29 PROP. CATCH BASIN
GRATE = 1025.32
CONSTRUCT OVER EX. STM. SEWER.

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**DOCUMENT 004113 - BID FORM - STIPULATED SUM
(SINGLE-PRIME CONTRACT)**

PART 1 - GENERAL

1.1 BID INFORMATION

- A. Bidder: _____.
- B. Project Name: Facility Renovation, Family Health.
- C. Project Location: 5735 Meeker Rd., Greenville, OH 45331.
- D. Owner: Family Health Services of Darke County, OH.
- E. Architect: App Architecture, Inc.
- F. Architect Project Number: 3853.03.

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 App Architecture, Inc. 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. For the stipulated sum of: _____ Dollars
(\$_____).
- B. Unit Price UP-No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material beyond the base bid amount.
 - 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 Civil Drawings and specification notes.
 - 2. Unit of Measurement: cubic yard of soil excavated, based on in-place surveys of volume before and after removal.

For the unit price of: _____ Dollars (\$_____)/cubic yard.

- C. Unit Price UP-No. 2: Removal of unsatisfactory soil and replacement with lean concrete material under footings beyond the base bid amount.

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 Civil Drawings and specification notes and Structural Drawings and specifications.

1. Base Bid: 6'-0" of lean concrete under all footings in the east Expansion Area.
2. Unit of Measurement: cubic yard of soil excavated, based on in-place surveys of volume before and after removal.

For the unit price of: _____ Dollars (\$_____/cubic yard.

- D. Unit Price No. 3 – Interior Door Sound Seals:

1. Description: Provide sound seals in accordance with 087111 "Door Hardware."
2. Unit of Measurement: Per Single Door and Per Pair of Doors.

For the unit price of: _____ Dollars (\$_____/door opening.

- E. Bid Alternate No. A1: Provide all labor and material to remove and re-roof the entire asphalt shingle portions of existing structure.

1. Base Bid: Provide new roofing at additions and tie into existing roof as indicated on Drawings and as specified in Section 073113 "Asphalt Shingles" and 075419 "Polyvinyl-Chloride Roofing."

Alternate: Remove and re-roof the entire asphalt shingle portions of the existing building. Re-roof shall include ice guard from eave to 3' inside building exterior wall line at eaves, valleys and hip ridges, and entire areas under 4:12 pitch.

If Alternate No. A1 is accepted, revise Base Bid as follows:

All labor and material, for the sum of: **ADD or DEDUCT (circle one)**

For the sum of: _____ Dollars (\$_____).

- F. Bid Alternate No. A2: Provide labor and material for clad wood windows, TYPE A, in lieu of installing salvaged windows, TYPE A.

1. Base Bid: Remove (16) 5'-0" x 5'-0" clad wood windows, with care, and salvage for reinstallation. See Sheets A1.2A & A1.3A Demolition Note #2 and specified in Section 024119 "Selective Demolition." Install 'best' (11) salvaged 5'-0" x 5'-0" clad wood windows, TYPE A, at locations indicated on Drawings, See Sheets A1.2B, A1.3B & A1.4B Construction Note #41. Total of (11) locations.

2. Alternate: Remove and dispose of (16) 5'-0" x 5'-0" clad wood windows. Provide and install (11) new 5'-0" x 5'-0" storefront windows, TYPE A.
Frame color: Bronze.
Glazing: Match existing insulated glass panel and blinds. Section 085200 "Wood Windows."

If Alternate No. A2 is accepted, revise Base Bid as follows:

All labor and material, for the sum of: **ADD or DEDUCT (circle one)**

For the sum of: _____ Dollars (\$_____).

1.3 ACKNOWLEDGEMENT OF ADDENDA

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

1.4 ACKNOWLEDGEMENT OF INSURANCES

- A. The undersigned Bidder acknowledges the following insurances and bonding will be provided and costs are included in the bid amount.
 1. Liability and Builder's Risk Insurances as listed in Article 11 of the General and Supplemental Conditions: YES or NO (circle one)
 2. Performance Bond: YES or NO (circle one)
 3. Payment Bond: YES or NO (circle one)

1.5 BIDDERS CHECKLIST

- A. One copy of the following documents must accompany the bid form (see included forms in section 066000 "Project Forms."
 1. Subcontractor List.
 2. Schedule of Values List (to be submitted via email within three hours of the bid submission).

1.6 CONTRACTOR'S LICENSE

- B. The undersigned further states that it is a duly licensed contractor, for the type of work

proposed, in Darke County.

1.4 SUBMISSION OF BID

- A. Respectfully submitted this ____ day of _____, 2023.
- 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)

FAMILY HEALTH SERVICES OF DARKE COUNTY
FACILITY RENOVATION

2023

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 004113

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SECTION 006000 - PROJECT FORMS

PART 1 - GENERAL

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 A101-2017 "Standard Form of Agreement between Owner and Contractor Where the Basis of Payment is a Stipulated Sum."
 - a. The General Conditions for Project are AIA Document A201-2017 "General Conditions of the Contract for Construction."
 - 2. The General Conditions are included in the Project Manual.

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.aiacontractdocsaicontracts.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. Change Order Form: AIA Document G701-2017 "Change Order."
 - 3. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G710-2017 "Architect's Supplemental Instructions."
 - 4. 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."

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."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 006000

SUBCONTRACTOR LIST

Bidders shall list below the Major Subcontractors used in the completion of this bid. Where the Contractor will complete branches of work with his own forces, Contractor's name shall be listed. If a subcontractor is not planned for a particular area listed below, mark that space "N.A."

1. General Construction Work:

Subcontractor _____

2. Div. 31 Site Work:

Subcontractor _____

3. Div. 4 Masonry:

Subcontractor _____

4. Div. 5 Steel Framing:

Subcontractor _____

5. Div. 6 Casework:

Subcontractor _____

6. Div. 7 Roofing:

Subcontractor _____

7. Div. 8 Doors & Windows:

Subcontractors _____

8. Div. 21 Fire Suppression Work:

Subcontractor _____

9. Div. 22 Plumbing Work:

Subcontractor _____

10. Div. 23 Heating, Ventilating and Air Conditioning Work:

Subcontractor _____

11. Div. 26 Electrical Work:

Subcontractor_____

NOTE: If the Bidder can show just cause at the time of awarding the Contract that a specific Subcontractor has withdrawn his bid, or raised his bid, the Bidder may substitute a Subcontractor upon approval of the Owner and at no additional cost to Owner.

END OF FORM

SCHEDULE OF VALUES LIST

Bidders shall list below the Schedule of Values for their work and the Prime Sub-contractors noted below.

1. General Construction Work:

Base Bid Scheduled Value_____

2. Div. 31 Site Work:

Base Bid Scheduled Value_____

3. Div. 4 Masonry:

Base Bid Scheduled Value_____

4. Div. 5 Steel Framing:

Base Bid Scheduled Value_____

5. Div. 6 Casework:

Base Bid Scheduled Value_____

6. Div. 7 Roofing:

Base Bid Scheduled Value_____

7. Div. 8 Doors & Windows:

Base Bid Scheduled Values_____

8. Div. 21 Fire Suppression Work:

Base Bid Scheduled Value_____

9. Div. 22 Plumbing Work:

Base Bid Scheduled Value_____

10. Div. 23 Heating, Ventilating and Air Conditioning Work:

Base Bid Scheduled Value_____

11. Div. 26 Electrical Work:

Base Bid Scheduled Value_____

END OF FORM

DOCUMENT 006113 - PERFORMANCE BOND

The *Performance Bond*, AIA Document A312-2010, to be used is bound herein. Contractors shall use this form.

END OF DOCUMENT 006113

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AIA® Document A312® – 2010

Performance Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

Family Health Services of Darke County
5735 Meeker Road
Greenville, Ohio 45331

CONSTRUCTION CONTRACT

Date:

Amount: \$

Description:

(Name and location)

Facility Renovation
Family Health Services of Darke County
5735 Meeker Road
Greenville, Ohio 45331

BOND

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond: None See Section 16

CONTRACTOR AS PRINCIPAL

Company: *(Corporate Seal)*

Signature: _____

Name and

Title:

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

SURETY

Company: *(Corporate Seal)*

Signature: _____

Name and

Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- .1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
- .2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
- .3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

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

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

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

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

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

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

§ 14 Definitions

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

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

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

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

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

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

§ 16 Modifications to this bond are as follows:

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

CONTRACTOR AS PRINCIPAL

Company: _____ (Corporate Seal)

Signature: _____

Name and Title: _____

Address: _____

SURETY

Company: _____ (Corporate Seal)

Signature: _____

Name and Title: _____

Address: _____

DOCUMENT 006114 - PAYMENT BOND

The *Payment Bond*, AIA Document A312-2010, to be used is bound herein. Contractors shall use this form.

END OF DOCUMENT 006114

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AIA[®]

Document A312[®] – 2010

Payment Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

Family Health Services of Darke County
5735 Meeker Road
Greenville, Ohio 45331

CONSTRUCTION CONTRACT

Date:

Amount: \$

Description:

(Name and location)

Facility Renovation
Family Health Services of Darke County
5735 Meeker Road
Greenville, Ohio 45331

BOND

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond: None See Section 18

CONTRACTOR AS PRINCIPAL

Company: *(Corporate Seal)*

SURETY

Company: *(Corporate Seal)*

Signature: _____

Name and

Title:

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

Signature: _____

Name and

Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:

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

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

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

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

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

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

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

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

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

- .1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- .2 have sent a Claim to the Surety (at the address described in Section 13).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

§ 16 Definitions

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

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

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

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

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

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

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

§ 18 Modifications to this bond are as follows:

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

CONTRACTOR AS PRINCIPAL

SURETY

Company: _____ (Corporate Seal)

Company: _____ (Corporate Seal)

Signature: _____
Name and Title: _____
Address: _____

Signature: _____
Name and Title: _____
Address: _____

SECTION 007200 - GENERAL CONDITIONS

General Conditions of the Contract for Construction, AIA Document A201-2017 Edition, is hereby made a part of this Project Manual and bound herein.

END OF SECTION 007200

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AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

Facility Renovation
Family Health Services of Darke County
5735 Meeker Road
Greenville, Ohio 45331

THE OWNER:

(Name, legal status and address)

Family Health Services of Darke County
5735 Meeker Road
Greenville, Ohio 45331

THE ARCHITECT:

(Name, legal status and address)

App Architecture, Inc.
615 Woodside Drive
Englewood, Ohio 45322

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- 11 INSURANCE AND BONDS
- 12 UNCOVERING AND CORRECTION OF WORK
- 13 MISCELLANEOUS PROVISIONS

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.

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.

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

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

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

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

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

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

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

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

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

§ 3.3 Supervision and Construction Procedures

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

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

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

§ 3.4 Labor and Materials

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

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

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

§ 3.5 Warranty

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

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent

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

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

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

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

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

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

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

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

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

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

§ 4.2 Administration of the Contract

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

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

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

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

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

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

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

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

§ 5.3 Subcontractual Relations

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

§ 5.4 Contingent Assignment of Subcontracts

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

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

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

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

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

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

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

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

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

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

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

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

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

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

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

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

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

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

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

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

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

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

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

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

§ 9.4 Certificates for Payment

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

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

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

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

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

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

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

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

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

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

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

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

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

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

§ 9.9 Partial Occupancy or Use

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

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

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

§ 9.10 Final Completion and Final Payment

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

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

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

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

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

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

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

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

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

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials and Substances

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

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

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

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

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

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

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

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

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act

or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 **Failure to Purchase Required Property Insurance.** If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 **Notice of Cancellation or Expiration of Owner's Required Property Insurance.** Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and

approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

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

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

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

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

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

§ 14.3 Suspension by the Owner for Convenience

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

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

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

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

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

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

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

§ 15.1.7 Waiver of Claims for Consequential Damages

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

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

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

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

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

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

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

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

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

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

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

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

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

§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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



DOCUMENT 00 7300 - SUPPLEMENTARY CONDITIONS

The following supplements modify the *General Conditions of the Contract for Construction*, AIA Document A201-2017. Where a portion of the General Conditions is modified or deleted by these supplementary conditions, the unaltered portions of the General Conditions shall remain in effect.

ARTICLE 1 - GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

Add the following sentence to the End of Section 1.1.1:

The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add Section 1.2.1.2 to Section 1.2.1:

1.2.1.2 In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

1. The Agreement.
2. Addenda, with those of later date having precedence over those of earlier date.
3. The Supplementary Conditions.
4. The General Conditions of the Contract for Construction.
5. Division 1 of the Specifications.
6. Drawings and Division 2-33 of the Specifications.

In the case of conflicts or discrepancies between Drawings and Divisions 2-33 of the Specifications or within either Document not clarified by Addendum; the Architect will determine which takes precedence in accordance with Subparagraph 4.2.11.

1.7 DIGITAL DATA USE AND TRANSMISSION

Add the following Section 1.9 to Article 1:

1.9 Representatives of the Owner, Contractor and Architect shall meet periodically at mutually agreed-upon intervals for the purpose of establishing procedures to facilitate cooperation, communication and timely responses among the participants. By participating in this arrangement, the parties do not intend to create additional contractual obligations or modify the legal relationships which may otherwise exist.

ARTICLE 2 - OWNER

2.3 INFORMATION AND SERVICES REQUIRED BY THE OWNER

Delete Section 2.3.6 and substitute the following:

The General Contractor will be furnished free of charge, electronic copies of Drawings and Project Manual.

ARTICLE 3 - CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

To Paragraph 3.2 add the following Subparagraph 3.2.5:

3.2.5 Do not scale the Drawings. Follow indicated dimensions. In case of any discrepancy in the figures, bring the matter to the attention of the Architect for decision before proceeding with the Work. Failure to follow this procedure shall be at the Contractor's own risk, and the Architect's decision shall be final.

3.4 LABOR AND MATERIALS

Delete Section 3.4.2 and substitute the following:

3.4.2 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications). By making requests for substitutions, the Contractor:

- .1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
- .2 represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
- .3 certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
- .4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

Add the following Section 3.4.4 to Section 3.4:

3.4.4 The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect to evaluate the Contractor's proposed substitutions and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of such substitutions.

3.6 TAXES

Add Subparagraph 3.61 to Section 3.6:

3.6.1 The Owner is exempt from State of Ohio sales and use tax laws and such taxes shall not be included in bid.

3.7 PERMITS, FEES AND NOTICES

Add the following two sentences to Section 3.7.1:

The Owner shall pay fees for public or private water, gas, electrical, and other utility extensions at the site. The Contractor shall secure and arrange for all necessary utility connections.

3.8 ALLOWANCES

Delete semicolon at end of Section 3.8.2.2 and add the following:

, except that if installation is included as part of an allowance in Divisions 1-33 of the Specifications, the installation and labor cost for greater or lesser quantities of Work shall be determined in accordance with Subparagraph 7.3.6;

3.9 SUPERINTENDENT

Delete Section 3.9.1 and substitute the following:

3.9.1 The Contractor shall employ a superintendent or an assistant to the superintendent who is responsible for coordinating Drawings, Specifications, and shop drawings pertaining to such systems. The coordinator shall assist the Subcontractors in arranging space conditions to eliminate interference between the mechanical and electrical systems and other Work and shall supervise will perform as a coordinator for mechanical and electrical Work. The coordinator shall be knowledgeable in mechanical and electrical systems and capable of reading, interpreting and the preparation of coordination drawings documenting the spatial arrangements for such systems within restricted spaces. The coordinator shall assist in planning and expediting the proper sequence of delivery of mechanical and electrical equipment to the site.

Add the following Sections to 3.9.1:

3.9.1.1 The Contractor shall submit an outline of the qualifications and experience of the Contractor's proposed superintendent, including references, to the Architect within ten (10) days of the Notice to Proceed.

3.9.1.2 The Owner reserves the right to reject the Contractor's proposed superintendent. Failure of the Architect to notify the Contractor within 30 days of receipt of the required information shall constitute notice that the Owner has no objection.

3.9.1.3 Should the Owner reject the Contractor's superintendent, the Contractor shall replace the superintendent at no additional cost.

3.9.1.4 The Contractor shall not change the Contractor's superintendent without written approval of the Owner.

3.9.1.5 If the Contractor proposes to change the Contractor's superintendent, the Contractor shall submit to the Architect a written justification for the change, along with the name and qualifications of the individual whom the Contractor proposes to be the new superintendent.

4.1 ARCHITECT

No Changes.

ARTICLE 5 – SUBCONTRACTORS

Delete Section 5.2.1, 5.2.2 and 5.2.3 and substitute the following:

5.2.1 (Modified Section)

Add the following Section 5.2.1.1 to Section 5.2.1:

5.2.1.1 Not later than 30 days after the date of commencement of the Work, the Contractor shall furnish in writing to the Owner through the Architect the names of persons or entities proposed as manufacturers, fabricators or material suppliers for the products, equipment and systems identified in the General Requirements (Division 1 of the Specifications) and, where applicable, the name of the installing Subcontractor.

ARTICLE 6 - CONSTRUCTION BY OWNER OF BY SEPARATE CONTRACT

No changes.

ARTICLE 7 - CHANGES IN THE WORK

7.1 GENERAL

Add the following Section 7.1.4 to Section 7.1:

7.1.4 The combined overhead and profit included in the total cost to the Owner of a change in the Work shall be based on the following schedule:

- .1 For the Contractor, for Work performed by the Contractor's own forces, 10 percent of the cost.
- .2 For the Contractor, for Work performed by the Contractor's Subcontractor, 5 percent of the amount due the Subcontractor.
- .3 For each Subcontractor involved, for Work performed by that Subcontractor's own forces, 10 percent of the cost.
- .4 For each Subcontractor involved, for Work performed by the Subcontractor's subcontractors, 5 percent of the amount due the Sub-subcontractor.
- .5 Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.
- .6 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in a manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving over \$500. be approved without such itemization.

ARTICLE 8 - TIME

No changes.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES

Add the following sentence to Section 9.2:

The form of Schedule of Values shall be that each major item of Work and each subcontracted item of Work is shown as a single line item on a current AIA Document G703 - 1992, Certificate of Payment, Continuation Sheet.

9.3 APPLICATIONS FOR PAYMENT

To Subparagraph 9.3.1 add the following sentence:

The form of application for Payment, duly notarized, shall be a current authorized edition of AIA Document G702 -1992, Application and Certification for Payment, supported by a current authorized edition of AIA Document G703 - 1992, Continuation Sheet.

Add the following Section 9.3.1.3 to Section 9.3.1:

9.3.1.3 Until the Work is 50 percent complete, the Owner shall pay 90 percent of the amount due the Contractor on account of progress payments. At the time the Work is 50 percent complete and thereafter, the Architect will authorize remaining partial payments to be paid in full.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

No changes.

ARTICLE 11 - INSURANCE AND BONDS

11.1 CONTRACTOR'S INSURANCE AND BONDS

To Section 11.1.1 add the following Sections 11.1.1.1 and 11.1.1.2:

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

1. Premises Operations
2. Independent Contractors' Protective
3. Products - Completed Operations
4. Personal Injury Liability
5. Contractual Liability
6. Personal and Advertising Injury
7. Owned, Non-Owned and Hired Motor Vehicles
8. Excess or Umbrella Liability

11.1.1.2 If the General Liability coverages are provide by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extended reporting period shall be required to be maintained after final payment,

certified in accordance with Subparagraph 9.10.2.

To Section 11.1.2 add the following Sections 11.1.2.1 through 11.1.2.4:

11.1.2.1 The limits for Worker's Compensation and Employers' Liability insurance shall meet statutory limits mandated by State and Federal Laws. If (1) limits of excess of those required by statute are to be provided or (2) the employer is not statutorily bound to obtain such insurance coverage of (3) additional coverages are required, additional coverages and limits for such insurance shall be as follows:

11.1.2.2 The limits for Commercial General Liability insurance including coverage for Premises-Operations, Independent contractors' Protective, Products-Completed Operations, Contractual Liability, Personal Injury and Broad Form Property Damage (including coverage for Explosion, Collapse and Underground hazards) shall be as follow:

\$1,000,000.	Each Occurrence
\$2,000,000.	General Aggregate
\$1,000,000.	Personal and Advertising Injury
\$2,000,000.	Products - Completed Operations Aggregate

.1 The policy shall be endorsed to have the General Aggregate apply to this Project only.

.2 The Contractual Liability insurance shall include coverage sufficient to meet the obligations in AIA Document A201-2017 under paragraph 3.18.

.3 Products and Completed Operations insurance shall be maintained for a minimum period of at least two (2) years after either 90 days following Substantial Completion or final payment, whichever is earlier.

11.1.2.3 Automobile Liability insurance (owned, non-owned and hired vehicles) for bodily injury and property damage shall be as follows:

\$1,000,000.	Each Accident
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11.1.2.4 Umbrella or Excess Liability coverage shall be as follows:

\$5,000,000.

11.1.2.5 Builder's Risk Insurance shall be provided in the amount of the construction cost of the project.

To Subparagraph 11.1.3 add the following sentence:

If this insurance is written on a Commercial General Liability policy form, the certificates shall be ACORD form 25-S, completed and supplemented in accordance with AIA Document G715 - 2017, Instruction Sheet and Supplemental Attached for ACORD Certificate of Insurance 25-S.

To Section 11.1.3 add Subparagraph 11.1.3.1 through 11.1.3.3:

11.1.3.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising there under. Bonds may be obtained through the Contractor's usual source and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to 10 percent of the Contract Sum.

11.1.3.2 The Contractor shall deliver the required bonds to the Owner not later than three days following the date the Agreement is entered into, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

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

Add Subparagraph 11.2.4 to Section 11.2:

If the Owner is damaged by the failure of the Contractor to purchase and maintain such insurance without so notifying the Owner in writing, then the Contractor shall bear all reasonable costs attributable thereto.

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

No change.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

To Article 13 add the following Section 13.6:

13.6 MECHANICS LIEN LAW

13.6.1 The Owner and all Contractors will comply with the regulations and requirements of Chapter 1311 of the Ohio Revised Code. Prior to the start of construction, the Owner will file a Notice of Commencement (NOC) with the county recorder where the project is located. A copy of the NOC will be posted on the job site and copies will be given to the Original Contractors, who, in turn, must provide copies to its Subcontractors, lower tier Subcontractors, suppliers and materialmen.

ARTICLE 14 - TERMINATION OR SUSPENSION OF CONTRACT

No changes.

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work under Owner's separate contracts.
5. Owner-furnished/Contractor-installed (OFICI) products.
6. Contractor's use of site and premises.
7. Coordination with occupants.
8. Work restrictions.
9. Specification and Drawing conventions.
10. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 017300 "Execution" for coordination of Owner-installed products.

1.2 PROJECT INFORMATION

A. Project Identification: Family Health Services of Darke County, Facility Renovation.

1. Project Location: 5735 Meeker Road, Greenville, OH 45331.

B. Owner: Family Health Services of Darke County.

1. Owner's Representative: Jared Pollick.

C. Architect: App Architecture, Inc.

1. Architect's Representative: Todd Gindelberger.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- ##### A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. Project consists of the existing West Building: 46,200 SF of Medical Clinic and Office Space, a new 2-hour fire wall, and the new East Building: 43,700 SF of Medical Clinic, Office, and Assembly space. West Building work will include the addition of sprinklers to the original 1986 building, 5,000 SF of infill additions to the 2006 building and limited interior renovations. East Building will be a 2-story new construction building. And other Work as indicated in the Contract Documents.

B. Type of Contract:

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

1.4 PHASED CONSTRUCTION

- A. Construct the Work in phases, with each phase substantially complete as indicated on Drawings.
- B. Before commencing Work of each phase, 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 all phases of the Work.

1.5 WORK UNDER OWNER'S SEPARATE CONTRACTS

- A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.
- B. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.
 1. Landscaping.
 2. Exterior and interior signage.
 3. Systems Furnishings.
 4. Dental Suite casegoods and equipment, including sinks and overhead exam lights.
 5. All new Midmark casework.
 6. Pharmacy Suite casegoods and equipment including pharmacy sinks.
 7. Low Voltage Cabling and systems equipment installation, including but not limited to the following:
 - a. Voice
 - b. Data
 - c. Wireless
 - d. Security
 - e. Audio/Visual Equipment

1.6 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFICI) 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 (OFICI) Products:
1. Re-purposed Midmark casework.
 2. Toilet accessories as noted in 102800 "Toilet, Bath, and Laundry Accessories".

1.7 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Restricted Use of Site: Each Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Limits on Use of Site: Confine construction operations to areas of Work indicated on the Drawings.
 2. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

- a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
- 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
- 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 - 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.9 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to between 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated. Preferred work hours may be modified to meet Project requirements if approved by Owner (and authorities having jurisdiction when applicable).
 - 1. Weekend Hours: Same as above with Owner's approval.
 - 2. Hours for Utility Shutdowns and work being performed in daytime occupied spaces: 7:00 pm - 7:00 am weekdays and approved weekends.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:
 - 1. Notify Architect, Owner not less than two days in advance of proposed utility interruptions.
 - 2. Obtain Architect's, Owner's written permission before proceeding with utility interruptions.
- D. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.
- E. Employee Screening: Comply with Contractor's requirements for drug and background screening of Contractor personnel working on Project site. No additional monitoring by Owner.
 - 1. Maintain list of approved screened personnel with Owner's representative.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 - 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications.

Unless otherwise indicated, linked information is not part of the Contract Documents.

4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - 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.
- C. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.2 DEFINITIONS

- A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.3 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. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

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

- B. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 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.

1.7 ADJUSTMENT OF ALLOWANCES

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Lump-Sum Allowance: Include the sum of \$8,000.00 for one exterior wall mounted sign as indicated on the Drawings.
 - 1. This allowance includes material, receiving, handling, and installation costs, and Contractor overhead and profit.
 - 2. Base bid work to include associated lighting, blocking/support for the sign.

- B. Allowance No. 2: Lump-Sum Allowance: Include the sum of \$200,000.00 for decorative pendant lighting fixtures in L102, L163, L164, L165, L172.
 - 1. This allowance includes materials, receiving, handling all installation, including wiring and switching, and Contractor overhead and profit.

END OF SECTION 012100

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SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.2 DEFINITIONS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material beyond the base bid amount.
 - 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 Civil Drawings and specification notes.
 - 2. Unit of Measurement: cubic yard of soil excavated, based on in-place surveys of volume before and after removal.

- B. Unit Price No. 2: Removal of unsatisfactory soil and replacement with lean concrete material under footings beyond the base bid amount.
 - 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 Civil Drawings and specification notes and Structural Drawings and specifications.
 - 2. Unit of Measurement: cubic yard of soil excavated, based on in-place surveys of volume before and after removal.

- C. Unit Price No. 3: Interior Door Sound Seals.
 - 1. Description: Provide sound seals in accordance with 087100 "Door Hardware."
 - 2. Unit of Measurement: Per single door and per pair of doors.

END OF SECTION 012200

SECTION 012300 - 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 similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other Work of the Contract.
- C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. A1: Provide all labor and material to remove and re-roof the entire asphalt shingle portions of existing structure.
1. Base Bid: Provide new roofing at additions and tie into existing roof as indicated on Drawings and as specified in Section 073113 "Asphalt Shingles" and 075419 "Polyvinyl-Chloride Roofing."
 2. Alternate: Remove and re-roof the entire asphalt shingle portions of the existing building. Re-roof shall include ice guard from eave to 3' inside building exterior wall line at eaves, valleys and hip ridges, and entire areas under 4:12 pitch.
- B. Alternate No. A2: Provide labor and material for clad wood windows, TYPE A, in lieu of installing salvaged windows, TYPE A.
1. Base Bid: Remove (16) 5'-0" x 5'-0" clad wood windows, with care, and salvage for reinstallation. See Sheets A1.2A & A1.3A Demolition Note #2 and specified in Section 024119 "Selective Demolition". Install 'best' (11) salvaged 5'-0" x 5'-0" clad wood windows, TYPE A, at locations indicated on Drawings, See Sheets A1.2B, A1.3B & A1.4B Construction Note #41. Total of (11) locations.
 2. Alternate: Remove and dispose of (16) 5'-0" x 5'-0" clad windows. Provide and install (11) new 5'-0" x 5'-0" storefront windows, TYPE A.
Frame color: Bronze.
Glazing: Match existing insulated glass panel and blinds. Section 085200 "Wood Windows."

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for products selected under an alternate.
 - 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.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form 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.
 - 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. 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.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. 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.
 - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
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.

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:

- 1. Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
 - a. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - 1) Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and

- similar considerations.
- 2) Requested substitution does not require extensive revisions to the Contract Documents.
 - 3) Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 4) Substitution request is fully documented and properly submitted.
 - 5) Requested substitution will not adversely affect Contractor's construction schedule.
 - 6) Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 7) Requested substitution is compatible with other portions of the Work.
 - 8) Requested substitution has been coordinated with other portions of the Work.
 - 9) Requested substitution provides specified warranty.
 - 10) If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500



SUBSTITUTION REQUEST FORM

615 Woodside Drive, Englewood, Ohio 45322
T 937.836.8898 F 937.832.3696

DATE: _____

TIME: _____

REQUEST NO.: _____

PROJECT: FAMILY HEALTH SERVICES FACILITY RENOVATION
GREENVILLE, OHIO

PROPOSED SUBSTITUTION: _____

REQUEST AUTHOR: _____ **REQUIRED REPLY DATE:** _____

REPLY: _____

REPLY AUTHOR: _____ **REPLY DATE:** _____

ATTACHMENTS:

ACTION REQUIRED:

DISTRIBUTION:

END OF SECTION 012500

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SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
 - 2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.2 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.

1.3 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.

- e. Quotation Form: Use forms acceptable to Architect.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 7. Proposal Request Form: Use form acceptable to Architect.

1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 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.

1.6 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.

1.7 WORK CHANGE DIRECTIVE

- A. Work Change Directive: Architect may issue a Work Change Directive on . Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 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 012600

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SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 2. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 3. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
 - 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Owner's name.
 - c. Owner's Project number.
 - d. Name of Architect.
 - e. Architect's Project number.
 - f. Contractor's name and address.
 - g. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.
3. 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.
4. 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.
5. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
6. Temporary Facilities: 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.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use AIA Document 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.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to 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.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application

- who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Schedule of unit prices.
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
 15. Data needed to acquire Owner's insurance.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Certification of completion of final punch list items.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. AIA Document G706.
 6. AIA Document G706A.
 7. AIA Document G707.

8. Evidence that claims have been settled.
9. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

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SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 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. Web-based Project management software package.
 - 6. Project meetings.
- B. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, 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.
- B. Key Personnel Names: Within seven days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance

at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in built facility. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and direction of Project coordinator to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.

1.5 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 to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Owner name.
 3. Owner's Project number.
 4. Name of Architect.
 5. Architect's Project number.
 6. Date.
 7. Name of Contractor.
 8. RFI number, numbered sequentially.
 9. RFI subject.
 10. Specification Section number and title and related paragraphs, as appropriate.
 11. Drawing number and detail references, as appropriate.
 12. Field dimensions and conditions, as appropriate.
 13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 14. Contractor's signature.
 15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716.
1. Attachments shall be electronic files in PDF format.
- 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 5 days of receipt of the RFI response.
 - E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project management software.
 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.
 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - 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 AutoCAD format.

4. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.
 - 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 Agreement included in this Project Manual. See Attachment A at end of section.
 5. The following digital data files will be furnished for each appropriate discipline:
 - a. Floor plans.
 - b. Reflected ceiling plans.
- B. Web-Based Project Management Software Package: Provide, administer, and use web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.
1. Web-based Project management software includes, at a minimum, the following features:
 - a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
 - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
 - c. Document workflow planning, allowing customization of workflow between project entities.
 - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
 - e. Track status of each Project communication in real time, and log time and date when responses are provided.
 - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
 - g. Processing and tracking of contract modifications.
 - h. Creating and distributing meeting minutes.
 - i. Document management for Drawings, Specifications, and coordination drawings, including revision control.
 - j. Management of construction progress photographs.
 - k. Mobile device compatibility, including smartphones and tablets.
 2. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.
- C. 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.
 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: 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.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.

- n. Preparation of Record Documents.
 - o. Use of the premises and existing building.
 - p. Work restrictions.
 - q. Working hours.
 - r. Owner's occupancy requirements.
 - s. Responsibility for temporary facilities and controls.
 - t. Procedures for moisture and mold control.
 - u. Procedures for disruptions and shutdowns.
 - v. Construction waste management and recycling.
 - w. Parking availability.
 - x. Office, work, and storage areas.
 - y. Equipment deliveries and priorities.
 - z. First aid.
 - aa. Security.
 - bb. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect 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. Possible conflicts.
 - i. Compatibility requirements.
 - j. Time schedules.
 - k. Weather limitations.
 - l. Manufacturer's written instructions.
 - m. Warranty requirements.
 - n. Compatibility of materials.
 - o. Acceptability of substrates.
 - p. Temporary facilities and controls.
 - q. Space and access limitations.

- r. Regulations of authorities having jurisdiction.
 - s. Testing and inspecting requirements.
 - t. Installation procedures.
 - u. Coordination with other work.
 - v. Required performance results.
 - w. Protection of adjacent work.
 - x. 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. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of Record Documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Procedures for completing and archiving web-based Project software site data files.
 - d. Submittal of written warranties.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Contractor's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. Coordination of separate contracts.
 - l. Owner's partial occupancy requirements.
 - m. Installation of Owner's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at weekly 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.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site use.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of Proposal Requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
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 013100

ATTACHMENT A

Agreement & Waiver For Transfer and Use of Architectural Electronic Files



615 Woodside Drive, Englewood, Ohio 45322

T 937.836.8898 F 937.832.3696

www.app-arch.com

PROJECT: _____

OWNER: _____

You (hereinafter “User”) have requested App Architecture (hereinafter “AA”) provide electronic files, which may include BIM files, (hereinafter “Electronic Files”) for User’s convenience and use in the preparation of shop drawings/coordination drawings related to this project only. AA is willing to accommodate this request subject to the following terms and conditions:

AA and User fully understand that the data contained in these Electronic Files are part of AA’s Instruments of Service, AA shall be deemed the author of the drawings and data, and shall retain all common law, statutory law, and other rights. Modifications to the Electronic Files are to be made only by AA or its Subconsultants through the RFI process. User shall not transfer the Electronic Files to any other party without the express written authorization of AA. These files are not a product and shall not be used by User or anyone else receiving this data through or from User for any other purpose other than as a convenience as described above. AA makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. Furthermore, any description of said Electronic Files shall not be deemed to create an implied or express warranty that such Electronic Files shall conform to said description.

User understands and accepts that Electronic Files deteriorate or can be modified inadvertently or otherwise without authorization by AA. Therefore, AA may remove all indication of its ownership or involvement from these Electronic Files. Furthermore, AA makes no representations as to compatibility, usability or readability of the files resulting from the use of software, application packages, operating systems, or computer hardware differing from those of AA. Nor does AA make any representation that these Electronic Files will have any particular durability or that they will not damage or impair the User’s computer or software.

The User acknowledges that the furnishing of these files in no way relieves the User from the responsibility for the preparation of shop drawings or other schedules as required by the Contract between the Contractor and the Owner including the need to check, confirm and coordinate the work with that of other contractors for this project.

User understands that these Electronic Files are not contract documents, they do not contain all the information of the contract documents. Significant differences may exist between these Electronic Files and corresponding hard copy documents due to addenda, change orders, revisions, layer visibility or other reasons. AA makes no representations as to the accuracy or completeness of these Electronic Files. User understands and agrees that in the event of a conflict, printed hard copy drawings and specifications issued by AA shall take precedence over Electronic Files. User understands and agrees that User alone is completely responsible, without limitation, to check and otherwise confirm the accuracy of all data on these Electronic Files. The User recognizes that the

AA does not have, and will not have, any duty or obligation to advise or give notice to the User of any future revisions or modifications to the originating Electronic Files.

The User acknowledges that the Electronic Files provided by AA are a graphical representation of the building in order to generate two-dimensional industry standard drawings. A Revit model will contain both 2D and 3D components. The data contained in the Electronic Files may not be 100% accurate and should not be used for dimensional control, building layout or similar purposes. Additionally, the User acknowledges that the information in the Electronic Files should be use for comparative purposes only and shall not be relied upon for accurate quantity estimates.

The User shall assume all risks and liabilities resulting from use of these Electronic Files. User agrees to make no claims and hereby waives, to the fullest extent permitted by law, any claims or causes of action of any nature whatsoever, including claims for consequential damages, against AA, its officers, directors, employees, agents, or sub-consultants which may arise out of or in connection with the use of the Electronic Files. Furthermore, User shall, to the fullest extent permitted by law, indemnify, defend, and hold harmless AA, its officers, directors, employees, agents, or sub-consultants from and against all claims, damages, losses, and expenses, including attorney fees, arising out of, or related to User's, or anyone else receiving this data through or from User, use of the Electronic Files. If User reproduces the Electronic Files or creates a derivative work based upon them, User shall remove or completely obliterate any professional seals, logos, and other indications on the documents of the identity of AA, its officers, directors, employees, agents, or sub-consultants.

Neither this Agreement nor use of these files shall alter the contractor's Contract for Construction in any way.

ELECTRONIC FILE FORMAT (SELECT ONE):

.DWG Format – List drawing sheets requested:

Revit Project Model (Model only, no Views included, no specific LOD):

The User agrees that the AA shall have no responsibility whatsoever for problems of any nature arising from transmitting and storing electronic files at a User requested FTP site or project management site or the conversion of the Electronic Files by the User or others for use in non-native applications. AA will not provide Electronic Files in compressed formats. The User agrees to accept the files in the format provided by AA, and that the User's conversion or electronic file storage at the User's at the User's requested site, shall be at the User's sole risk.

AA, at its sole discretion, may modify the Electronic Files before they are provided to the User. Such modifications may include, but are not limited to, removal of certain information. AA, at its sole discretion, may refuse to provide some or all Electronic Files requested by the User.

The availability of Electronic Files that were not prepared by AA is subject to the consent of the Owner and/or consultant that prepared those Electronic Files. AA will not negotiate with the Owner or consultant or repeatedly solicit the Owner or consultant to obtain consent. Neither this

Agreement and Waiver for Transfer and Use of Electronic Files nor any such separate Consultant's consent may be assigned or transferred by the User to any other person or entity.

USER (FIRM NAME): _____ **DATE:** _____

ADDRESS: _____

CITY: _____ **STATE:** _____ **ZIP:** _____

PHONE NO.: _____

SIGNED: _____ **EMAIL:** _____

NAME/TITLE (PRINTED): _____

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's Construction Schedule.
 - 2. Daily construction reports.
 - 3. Site condition reports.
 - 4. Unusual event reports.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.
 - 2. Section 014000 "Quality Requirements" for schedule of tests and inspections.

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. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- C. Event: The starting or ending point of an activity.
- D. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time belongs to Owner.
 - 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.
- E. Resource Loading: The allocation of labor and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file.
 - 2. PDF file.
- B. 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.
- C. Daily Construction Reports: Submit at weekly intervals.
- D. Site Condition Reports: Submit at time of discovery of differing conditions.
- E. Unusual Event Reports: Submit at time of unusual event.

1.4 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 scheduling component of Project management software package specified in Section 013100 "Project Management and Coordination," for current Windows operating system.
- B. Time Frame: Extend schedule from date established for commencement of the Work to date of Final Completion.
 - 1. Contract completion date to not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
 - a. Securing of approvals and permits required for performance of the Work.
 - b. Temporary facilities.
 - c. Owner interfaces and furnishing of items.
 - d. Interfaces with Separate Contracts.
 - e. Regulatory agency approvals.
 - f. Punch list.

3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 5. 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.
 6. 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. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 3. 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.
 4. 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. Seasonal variations.
 - g. Environmental control.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and the Contract Time.
- F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule three days 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.

- G. 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.
- H. 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.

1.5 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.
 - 5. Material deliveries.
 - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 7. Testing and inspection.
 - 8. Accidents.
 - 9. Meetings and significant decisions.
 - 10. Unusual events.
 - 11. Stoppages, delays, shortages, and losses.
 - 12. Orders and requests of authorities having jurisdiction.
 - 13. Change Orders received and implemented.
 - 14. Construction Change Directives received and implemented.
 - 15. Services connected and disconnected.
 - 16. Equipment or system tests and startups.
 - 17. Partial completions and occupancies.
 - 18. 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.

- C. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

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SECTION 013233 - 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 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
 3. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.
 4. 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 by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
 2. Identification: Provide the following information with each image description in web-based Project management software site:
 - 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.

FACILITY RENOVATION
1.3 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. 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 from camera.
- D. File Names: Name media files with date, Project area and sequential numbering suffix.

1.4 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs with maximum depth of field and in focus.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. 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 excavation areas, 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.
- C. 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.
- D. Periodic Construction Photographs: Take 20 photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.
- E. Final Completion Construction Photographs: Take 100 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

- F. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs shall be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 013233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
5. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
6. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
7. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
8. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
9. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's 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. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

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 Contractor.
 5. Name of firm or entity that prepared submittal.
 6. Names of subcontractor, manufacturer, and supplier.
 7. Category and type of submittal.
 8. Submittal purpose and description.
 9. Number and title of Specification Section, with paragraph number and generic name

- for each of multiple items.
10. Drawing number and detail references, as appropriate.
 11. Indication of full or partial submittal.
 12. Location(s) where product is to be installed, as appropriate.
 13. Other necessary identification.
 14. Remarks.
 15. 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. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
 2. Paper: Prepare submittals in paper form and deliver to Architect.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as

follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 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. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

- a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's 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 concurrently with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.

- f. Specification paragraph number and generic name of each item.
3. 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.
4. Paper Transmittal: Include paper transmittal, including complete submittal information indicated.
5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
6. 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.
7. 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:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.

- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
 - 1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 - 2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 - 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 - 4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
 - 5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
 - 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
 - 1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
 - 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 - 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 - 4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 - 5. Product Test Reports: Submit written reports indicating that current product

produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

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 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.
 1. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.
 - a. Actions taken by indication on Project management software website have the following meanings:
 - 1) Reviewed.
 - 2) Reviewed and Noted.
 - 3) Revise and Resubmit.
- 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 discard 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 013300

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Project Submittal Cover Sheet

Date: _____

Submittal Number _____

Submittal Name: _____

Spec Section No: _____

Project: Family Health Services of Darke County
Facility Renovation
Greenville, Ohio

General Contractor: _____

PH. _____ FAX: _____

Subcontractor: _____ Supplier Name: _____

Architect: App Architecture
615 Woodside Drive
Englewood, OH 45322

General Contractor's Approval Stamp

Architect's/Engineer's Action Stamp

END OF SECTION 013300

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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, 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. 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.

- E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with 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.
- F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- G. 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."
- H. 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.
- I. 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 INFORMATIONAL SUBMITTALS

- A. 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.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- C. Reports: Prepare and submit certified written reports and documents as specified.
- D. 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.

1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.

6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement of whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement of whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.7 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 is similar in material, design, and extent to those indicated for this Project.
- F. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, 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.

1.8 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and 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, and the Contract Sum will be adjusted by Change Order.

- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect 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.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in the Statement of Special Inspections attached to this Section, and as follows:

1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Submitting a certified written report of each test, inspection, and similar quality-

- control service to Architect with copy to Contractor and to authorities having jurisdiction.
3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
 5. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 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 reference during normal working hours.
 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

- A. 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, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges for work occurring in the existing building. Provide connections and extensions of services as required for construction operations. The new East Building will require provision by contractor of temporary service for construction activities until the new service is operational.

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. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- C. Project Identification and Temporary Signs: Show fabrication and installation details,

including plans, elevations, details, layouts, timesteps, graphic elements, and message content.

- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- E. 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.
- F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste-handling procedures.
 - 5. Other dust-control measures.
- G. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
 - 1. Methods used to meet the goals and requirements of the Owner.
 - 2. Concrete cutting method(s) to be used.
 - 3. Location of construction devices on the site.
 - 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
 - 5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.
 - 6. Indicate locations of sensitive patient areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.

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.

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized-steel bases for supporting posts.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.
- C. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.
- D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices: 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-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.
 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating, 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."
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

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.
 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 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: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- 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.
 - 1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.
- 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: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- 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 WiFi cell phone access equipment, and, one land-based telephone line(s) for each field office.
 - 1. Provide additional telephone lines for the following:
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Engineers' offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.
- I. Electronic Communication Service: Provide secure WiFi wireless connection to internet

with provisions for access by Architect and Owner.

- J. Project Computer: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
 - 1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
 - 2. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum 10.0 -Mbps upload and 15 -Mbps download speeds at each computer.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
 - 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads or construction parking/staging and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 312000 "Earth Moving."
 - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.

- D. Parking: Use designated areas of future parking lot for construction personnel. Contractor to prepare base in manner to protect soils and grade for final future parking lot conditions.
- 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 a 4'x8' project identification signs.
 - 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. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- J. Temporary Elevator Use: See Division 14 elevator Section for temporary use of new elevators.
- K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 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.
 - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. 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.
- D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate

temporary enclosures.

- K. Temporary 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 where indicated on the Drawings.
 2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood where indicated on the Drawings.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 4. Insulate partitions to control noise transmission to occupied areas.
 5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 6. Protect air-handling equipment.
 7. Provide walk-off mats at each entrance through temporary partition.
- L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 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.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 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. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
 - 2. Section 012300 "Alternates" for products selected under an alternate.
 - 3. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 4. Section 017700 "Closeout Procedures" for submitting warranties.

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, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the

significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. 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.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

- a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

- ventilation, and weather-protection requirements for storage.
- 7. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
1. Construction layout.
 2. Field engineering.
 3. Installation.
 4. Cutting and patching.
 5. Coordination of Owner's portion of the Work.
 6. Progress cleaning.
 7. Starting and adjusting.
 8. Protection of installed construction.
 9. Correction of the Work.
- B. Related Requirements:
1. Section 011000 "Summary" for coordination of Owner-furnished products,, Owner's separate contracts, and limits on use of Project site.
 2. Section 013300 "Submittal Procedures" for submitting surveys.
 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
 5. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.

- B. Certified Surveys: Submit two copies signed by land surveyor.
- C. Certificates: Submit certificate signed by land surveyor, 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. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."
- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Plumbing piping systems.
 - f. Mechanical systems piping and ducts.
 - g. Control systems.
 - h. Communication systems.
 - i. Fire-detection and -alarm systems.
 - j. Electrical wiring systems.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased

maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

- a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and

construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.
- 3.2 PREPARATION
- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect 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 land surveyor experienced in laying out the Work, using the following accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 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. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb, and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with

materials so as not to void existing warranties.

- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete, and, Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other

- finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
 - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

- A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.
 - 1. Provide temporary facilities required for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.
 - 2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.
 - 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.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, in accordance with regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces in accordance with written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

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

3.10 PROTECTION OF INSTALLED CONSTRUCTION

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

3.11 CORRECTION OF THE WORK

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

END OF SECTION 017300

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SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Disposing of nonhazardous demolition, and, construction waste.
- B. Related Requirements:
 - 1. Section 042200 "Concrete Unit Masonry" for disposal requirements for masonry waste.
 - 2. Section 044313.13 "Anchored Stone Masonry Veneer" 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.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

- B. Burning: Do not burn waste materials.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final Completion procedures.
 - 3. List of incomplete items.
 - 4. Submittal of Project warranties.
 - 5. Final cleaning.

- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
 - 2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
 - 3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 5. Section 017900 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

- A. 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.

1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise

- Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit Final Completion photographic documentation.
- 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. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first, and, proceeding from lowest floor to highest floor, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by uploading to web-based project software site.
- 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.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar

- spaces.
 - h. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
 - i. Vacuum and mop concrete.
 - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.
 - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels that are not permanent.
 - m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
 - q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - r. Clean strainers.
 - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 CORRECTION OF THE WORK

- A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 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 by uploading to web-based project software site. Enable reviewer comments on draft submittals.

- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect 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.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 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. 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."

1.6 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.

1.7 SYSTEMS AND EQUIPMENT OPERATION MANUALS

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

4. Equipment function.
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.

1.8 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and

maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and

telephone number of service agent.

- I. 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.

1.9 PRODUCT MAINTENANCE MANUALS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings (As-Built): Comply with the following:
 - 1. Number of Copies: Submit one hard copy set(s) of marked-up record prints and one color PDF electronic file of scanned Record Prints.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 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.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings 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. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

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.
- B. Format: Submit record specifications as annotated PDF electronic file.

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 annotated PDF electronic file.
 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
1. 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. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date of video recording.
 2. Transcript:
 - a. Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.

3. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate 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. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.

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

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

1.7 PREPARATION

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

1.8 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- B. 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.
- C. 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.
- D. 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. 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 by uploading to web-based Project software site.
 - 2. File Hierarchy: Organize folder structure and file locations in accordance with Project Manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged in accordance with Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- B. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- C. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 - 1. Furnish additional portable lighting as required.
- D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.
3. Civil Engineering drawings and specification notes.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 1. Inspect and discuss condition of construction to be selectively demolished.
 2. Review structural load limitations of existing structure.

3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control, and, , for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
- D. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 1. Before selective demolition, Owner will remove the following items:
 - a. Furnishings.

- b. Artwork.
 - c. Dental equipment.
 - d. Miscellaneous clinical items.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials:
 - 1. It is not expected that hazardous materials will be encountered in the Work.
 - a. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
 - 1. Existing EPDM roofing.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.9 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
 - 1. Inventory and record the condition of items to be removed and salvaged.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

- e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
- g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid

4. marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items: (As indicated on the Drawings)
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area off-site.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items: (As indicated on the Drawings)
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS
- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove

remainder of concrete. Neatly trim openings to dimensions indicated.

- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings. Do not use methods requiring solvent-based adhesive strippers.
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing so that building interior remains watertight and weathertight. See Section 073113 "Asphalt Shingles" for new roofing requirements.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

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SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 - When the information in this Specification Section conflicts with information on the Structural Construction Drawings, the Structural Construction Drawings shall prevail.

PART 2 - GENERAL

2.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

2.2 ACTION SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Fiber reinforcement.
 - 2. Waterstops.
 - 3. Curing compounds.
 - 4. Floor and slab treatments.
 - 5. Vapor retarders.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.

2.3 INFORMATIONAL SUBMITTALS

- A. Slab Jointing Plan: Contractor to indicate location of slab-on-grade contraction joints and construction joints.
 - 1. Joints shall be spaced in a square or rectangular pattern with aspect ratio not to exceed 1.5:1.
 - 2. Spacing shall not exceed 36 times the slab thickness (in inches).
 - 3. Do not joint slab-on-grade below wood gymnasiums floors; see Shrinking Reducing Admixture.
- B. Field quality-control reports, including floor surface flatness and levelness measurements indicating compliance with specified tolerances.

2.4 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

2.5 QUALITY ASSURANCE

- A. Quality Standard: ACI 301.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
- C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

2.6 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1.
 - 1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301.

PART 3 - PRODUCTS

3.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.

3.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips.
- C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces. Provide rust inhibitor.
- D. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

3.3 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C 150, Type I/II, gray.
2. Blended Hydraulic Cement: ASTM C595/C595M, Type II, Portland-limestone cement.
3. Fly Ash: ASTM C 618, Class F or C.
4. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S, graded.

1. Maximum Coarse-Aggregate Size:
 - a. Slabs 2" and less in thickness: 3/8 inch nominal.
 - b. Slabs over 2" thickness, up through 10" thickness: 1 inch nominal.
 - c. Members over 10" thick: 1 1/2 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C 260.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

E. Shrinking Reducing Admixture

1. Admixture not permitted if Moisture Vapor Reduction Admixture is used.
2. Use in Gymnasium slab-on-grade.
3. Application rate shall be between 0.5 and 2.0 gallons per cubic yard. The mix design should provide a slab that requires no joints in the gymnasium.
4. Acceptable Manufacturers:
 - a. Eclipse Floor: Grace Construction Products
 - b. Peramin SRA110 and SRA220: Perstorp Polyois Inc.; Toledo, Ohio
 - c. Tetraguard AS20 by Master Builders/Nihon Cement Company

F. Water: ASTM C 94 and potable.

3.4 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60, deformed.
- B. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.
- C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

3.5 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."
- B. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- C. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy coated.
- D. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.

3.6 FIBER REINFORCEMENT

- A. Synthetic Macro-Fiber: Blended monofilament and fibrillated polypropylene macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, no less than 2 inches long.
- B. Fiber shall be accepted by the Steel Deck Institute for replacement of non-structural welded-wire-fabric in slab-on-metal deck applications per ASTM D 7508 and SDI C-2017 (paragraph 2.1, D,2).
- C. Acceptable Manufacturers:
 - 1. Forta-Ferro, Forta Corporation
 - 2. Tuf-Strand SF, Euclid
 - 3. Strux 90/40, GCP Applied Technologies

3.7 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

3.8 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A, 15 mils thick low-permeance polyolefin with Water Vapor Permeance (ASTM E96): 0.025 gr./ft²/hr. or lower. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products shall include:
 - a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
 - b. Fortifiber Building Systems Group; Moistop Ultra 15.
 - c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
 - d. Meadows, W. R., Inc.; Perminator 15 mil.
 - e. Reef Industries, Inc.; Griffolyn 15 mil.
 - f. Stego Industries, LLC; Stego Wrap 15 mil Class A.

3.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating; to be used at all concrete floors scheduled to receive applied finish materials.

3.10 RELATED MATERIALS

- A. Exposed concrete floor sealer: W.R. Meadows, Liqui-Hard, concrete densifier and chemical hardener or equal product.
- B. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- C. Round Concrete Cast-In-Place Column Fiber Forms: Multiple layers of 100 percent recycled paperboard, spirally wound, and laminated with adhesive.
 - 1. Interior Surface: Smooth with spiral seam. Alathon release and moisture barrier coating.
 - 2. Exterior Surface: Micryl moisture barrier coating.
 - 3. Spiral Mark: Impart visible spiral mark on concrete columns.
 - 4. 1-piece, 1-time-use forms.
 - 5. Recyclable.

3.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Ground Granulated Blast-Furnace Slag: 35 percent.
 - 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 2. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

3.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Trench Footings, Footings, and Interior Foundations: Proportion Normal-Weight Concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3000 psi at 28 days.
 - 2. Maximum W/C Ratio: 0.53.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
- B. Foundation and Retaining Walls exposed to Exterior: Proportion Normal-Weight Concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Slump Limit: 5 inches, plus or minus 1 inch.
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
 - 5. Mid-Range Water Reducer Required
- C. Exterior Slabs-on-Grade walks, stoops, steps, aprons, and curbs: Proportion Normal-Weight Concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4500 psi at 28 days.
 - 2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
 - 3. Maximum W/C Ratio: 0.45.
 - 4. Slump Limit: 4 inches, plus or minus 1 inch.
 - 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
 - 6. Finish: Nonslip Broom Finish (NsBrm-Fn)
- D. Exterior formed concrete exposed to view; exterior concrete not otherwise indicated: Proportion Normal-Weight Concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4500 psi at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
- E. Interior Slabs-on-Grade including Equipment Housekeeping Pads: Proportion Normal-Weight Concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
 - 3. Maximum W/C Ratio: 0.45.
 - 4. Slump Limit: 4 inches, plus or minus 1 inch.
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
 - 6. Mid-Range Water Reducer Required
 - 7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 4.0 lb/cu. yd.
- F. Interior Slabs-on-Composite Metal Deck: Proportion Normal-Weight Concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3500 psi at 28 days.
 - 2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
 - 3. Maximum W/C Ratio: 0.50.
 - 4. Slump Limit: 4 inches, plus or minus 1 inch.

5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
 6. Mid-Range Water Reducer Required
 7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 4.5 lb/cu. yd.
- G. Metal stair pan fill: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 2500 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.55.
 3. Maximum Aggregate Size: #8.
 4. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- H. Flowable Fill – Type 1 - Utility Trench Backfill: Proportion normal-weight concrete mixture as follows:
1. Compressive Strength: 50 - 100 psi at 28 days.
 2. Unconfined compression strength per ASTM D4832
- I. Flowable Fill – Type II – Under Foundations: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 100 psi at 28 days.
 2. Unconfined compression strength per ASTM D4832
- J. Lean Concrete fill at soft soils: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 1500 psi at 28 days.

3.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

3.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 4 - EXECUTION

4.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
 2. Class C, 1/2 inch for rough-formed finished surfaces.
- D.

- E. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- F. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- G. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

4.2 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
- B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

4.3 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

4.4 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- B. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- C. Coordinate pipe, sleeves, conduits, and other utilities prior to placing concrete.

4.5 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Vapor Retarder is to be used directly below slab-on-grade.

2. Lap joints 6 inches and seal with manufacturer's recommended tape.

4.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 1. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 2. Space vertical joints in walls not to exceed the guidelines as described on the contract documents. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: 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.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 9200 "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.
 4. Provide round isolation joints at all steel columns. Size round column fiber forms to maintain minimum 2" clearance of base plate.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

4.7 WATERSTOP INSTALLATION

- A. Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions. Install in longest lengths practicable.

4.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project Site, or during placement unless explicitly noted on approved mix design.

- C. 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. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

4.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish (RfFm-Fn): As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish (SmFm-Fn): As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated on the Drawings:
 - 1. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1-part Portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

4.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finishes: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Float Finish (Flt-Fn) - Noncritical Floors
 - a. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, subfloors under concrete toppings, thickset tile, sand bed terrazzo, and raised computer floors.
 - b. Finish surfaces to the following tolerances, according to ASTM E 1155:
 - 1) Specified overall values of flatness, F(F) 20; and of levelness, F(L) 15; with minimum local values of flatness, F(F) 14; and of levelness, F(L) 10.
- C. Trowel Finishes: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Trowel Finish 1 (Tr-Fn1) – Carpeted Floors, unless otherwise noted.
 - a. Apply trowel finish to monolithic slab surfaces that are to receive carpet and noncritical floors where slabs remain exposed, such as mechanical rooms, unless otherwise noted.
 - b. Finish surfaces to the following tolerances, according to ASTM E 1155:
 - 1) Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 14.
 - 2. Trowel Finish 2 (Tr-Fn2) – Floors with improved flatness/levelness requirements.
 - a. Apply trowel finish to monolithic slab surfaces that are to receive thin-set flooring, resilient flooring, linoleum flooring, fluid-applied flooring, resinous flooring and other flooring types, unless otherwise indicated.
 - b. Finish surfaces to the following tolerances, according to ASTM E 1155:
 - 1) Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17.

- 2) At thin-set tile floors, maximum permissible variation shall be $\frac{1}{4}$ inch to 10 feet from required plane. After surface is steel troweled and while concrete is still plastic, apply a fine broom finish.
 3. Trowel Finish 3 (Tr-Fn3) – Floors requiring better than average flatness/levelness.
 - a. Apply trowel finish to monolithic slab surfaces that are scheduled to receive a polished concrete finish, unless otherwise noted.
 - b. Finish surfaces to the following tolerances, according to ASTM E 1155:
 - 1) Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.
 4. Trowel Finish 4 (Tr-Fn4)
 - a. Apply trowel finish to wood covered floors, and with other floor finishes as indicated in their technical sections and required by their manufacturers.
 - b. Finish surfaces to the following tolerances, according to ASTM E 1155:
 - 1) Specified overall values of flatness, F(F) 50; and of levelness, F(L) 40; with minimum local values of flatness, F(F) 34; and of levelness, F(L) 27.
 - 2) The slab shall be steel troweled to a true level and finished smooth and straight to a tolerance of $\frac{1}{8}$ inch in any 10 foot radius.
- D. Nonslip Broom Finish (NsBrm-Fn): Apply a nonslip broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

4.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Equipment Housekeeping Pads:
 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 2. Construct concrete bases 4 inches high unless otherwise indicated; and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 3. Install hooked dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch 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 substrate.
 5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 6. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

4.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project. Coordinate with finish flooring material manufacturer requirements.
 - 4. Sealing Compound: Apply uniformly to floors and slabs indicated to receive sealer as final floor finish, in a continuous operation by power spray or roller according to manufacturer's written instructions.

4.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar. Notify Architect of repairs and provide detailed methods for approval prior to beginning repairs.
- C. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- D. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface.

Defects also include stains and other discolorations in public view that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces by blending white Portland cement and standard Portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
- E. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

4.14 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.

- B. Inspections:
1. Steel reinforcement placement.
 2. Headed bolts and studs.
 3. Verification of use of required design mixture.
 4. Concrete placement, including conveying and depositing.
 5. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 6. Compression Test Specimens: ASTM C 31.
 7. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. 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.
 10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may not be used.
 12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting

agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

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.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033000

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Embedded flashing.
6. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

C. Related Requirements:

1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.
 - a. Include data on material properties, material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
2. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
3. Grout mixes. Include description of type and proportions of ingredients.
4. Reinforcing bars.
5. Joint reinforcement.
6. Anchors, ties, and metal accessories.

C. 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.

D. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 1. Determine net-area compressive strength of masonry from average net-area

compressive strengths of masonry units and mortar types (unit-strength method) in accordance with TMS 602/ACI 530.1/ASCE 6.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C90.
 - 1. Density Classification: Normal weight.
 - 2. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - 1. Alkali content is not 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. Aggregate for Mortar: ASTM C144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
- E. Water: Potable.

2.6 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hohmann & Barnard, Inc
 - b. Wire-Bond
- C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.
 - 1. Interior Walls: Mill- galvanized carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch diameter.
 - 5. Spacing of Cross Rods: Not more than 16 inches o.c.
 - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.7 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Stainless Steel Wire: ASTM A580/A580M, Type 304.
 - 2. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6

inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805, or, PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.9 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use Portland cement-lime mortar unless otherwise indicated.
 - 3. For reinforced masonry, use Portland cement-lime mortar.
 - 4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type N.
 - 3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 4. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- D. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 2. For location of elements in plan, do not vary from that indicated by more than plus

or minus 1/2 inch.

3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use

units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 - 3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow 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.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Wet joint surfaces thoroughly before applying mortar.
 - 3. Rake out mortar joints for pointing with sealant.
- D. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch 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.
- G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 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 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.

2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.9 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 other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements is done at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level B in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140 for compressive strength.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
- F. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.
- G. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at **7 days and at]28 days.**

3.11 PARING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove 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 042200

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SECTION 042613 - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brick.
2. Mortar materials.
3. Ties and anchors.
4. Embedded flashing.
5. Accessories.
6. Mortar mixes.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in masonry veneer.

C. Related Requirements:

1. Section 044313.13 "Anchored Stone Masonry Veneer" for stone set as anchored veneer.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification:

1. Clay face brick, in the form of straps of five or more bricks to be reviewed on site to verify match of existing brick.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:

1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of

- ingredients.
- 5. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar. 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.
- C. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.5 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down face of veneer, and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain exposed masonry units from single source producer.
- B. For exposed masonry units, and, cementitious mortar components, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 1. Where fire-resistance-rated construction is indicated, use the equivalent thickness method for masonry units in accordance with ACI 216.1.

2.3 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including corners, movement joints, bond beams, sashes, and lintels, requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing, where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: Facing brick complying with ASTM C216, Grade SW, Type FBX.
1. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.
 2. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
 3. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
 4. Application: Use where brick is exposed unless otherwise indicated.
 5. Where shown to "match existing," provide clay face brick matching color range, texture, and size of existing adjacent brickwork.
 - a. The Belden Brick Company: Belcrest #560. Previously supplied by Wayne Building Supply, Greenville, Ohio.

2.4 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
- D. Preblended Dry Mortar Mix: Packaged blend made from Portland cement and hydrated lime, sand, and admixtures and complying with ASTM C1714/C1714M.

1. Preblended Dry Portland Cement Mortar Mix:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerimix is a trademark of Bonsal American, an Oldcastle company
 - b. Quikrete; The QUIKRETE Companies, LLC
 - c. Sakrete; CRH Americas, Oldcastle APG

E. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Manufacturers: Subject to compliance with requirements, :
 - a. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
 - b. GCP Applied Technologies Inc.

G. Water: Potable.

2.5 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Stainless Steel Wire: ASTM A580/A580M, Type 304.

C. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.

D. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Masonry-Veneer Anchors; Single-Barrel Screw with Double-Pintle Wingnut: Self-drilling, single-barrel screw with wingnut head designed to receive double-pintle wire

tie. Screw has a smooth barrel the same thickness as insulation with factory-installed gasketed washer to seal at face of insulation and sheathing, and a coating to reduce thermal conductivity.

- a. Basis-of-Design Product: Subject to compliance with requirements, provide Hohmann & Barnard, Inc. Thermal 2-Seal Wing Nut Anchor or comparable product by one of the following:
 - a. Heckmann Building Products, Inc.

2.6 EMBEDDED FLASHING

A. Metal Flashing:

1. General: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - a. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
 - b. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft. Provide splice plates at joints of formed, smooth metal flashing.
 - c. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
 - d. Fabricate through-wall flashing without drip edge unless otherwise indicated.
 - e. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
 - f. Solder metal items at corners.

B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Stainless Steel Fabric Flashing: Composite flashing product consisting of 2 mil of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric, to produce an overall thickness of 40 mil.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hohmann & Barnard, Inc
 - b. Wire-Bond

C. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain

watertight.

- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.7 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, urethane, PVC.
- B. Weep/Vent Products: Use one of the following unless otherwise indicated:
 - 1. Wicking Material: Absorbent rope, made from cotton, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity. Use only for weeps.
- C. 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 cavity, with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity to prevent weep holes from clogging with mortar.
 - 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:
 - a. Advanced Building Products Inc.
 - b. Wire-Bond
- D. Offset Angle Supports: Steel plate brackets anchored to structure, allowing continuous insulation behind shelf angle supporting veneer. Component and anchor size and spacing engineered by manufacturer.
 - 1. Manufacturers: Subject to compliance with requirements, :
 - a. FERRO Corporation
 - b. Halfen USA, Inc.
 - c. Hohmann & Barnard, Inc
- E. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.; a Hohmann & Barnard company
 - b. EaCo Chem, Inc.
 - c. PROSOCO, Inc

2.8 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use Portland cement-lime mortar unless otherwise indicated.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Use Type N unless another type is indicated.
 1. For masonry below grade or in contact with earth, use Type S.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- B. 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.

- C. 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.
- D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

- 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
- 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
- 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

- 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
- 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
- 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
- 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
- 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
- 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.

C. Joints:

- 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
- 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
- 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
- 4. For exposed head joints, do not vary from thickness indicated by more than plus or

minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick with face shells fully bedded in mortar and with head joints of depth equal to bed joints. At starting course, fully bed entire units, including area under cells.
 1. At anchors and ties, fully bed units and fill cells with mortar as needed to fully embed anchors and ties in mortar.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
 1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

3.6 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing, concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
 1. Fasten screw-attached anchors through sheathing to wall framing, and, 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 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
- B. Provide not less than not less than indicated on the Drawings of airspace between back of masonry veneer and face of insulation.
1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 EXPANSION JOINTS

- A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints as follows:
1. Build in compressible joint fillers where indicated.
 2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

3.8 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

- B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
 3. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.
 4. Interlock end joints of sawtooth sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 5. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
1. .
 2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 3. Space weep holes 24 inches o.c. unless otherwise indicated.
 4. Space weep holes formed from plastic tubing 16 inches o.c.
 5. Trim wicking material flush with outside face of wall after mortar has set.
- D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.

3.10 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and non-masonry 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 masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.11 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove 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 042613

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SECTION 044313.13 - ANCHORED STONE MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stone masonry anchored to wood framing and sheathing.
2. Stone masonry anchored to cold-formed metal framing and sheathing.
3. Mortar materials.
4. Ties and anchors.
5. Embedded flashing
6. Accessories.
7. Mortar mixes.

B. Products Installed but Not Furnished under This Section Include:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.

C. Related Requirements:

1. Section 042200 "Concrete Unit Masonry."

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.
- B. Samples for Initial Selection: For colored mortar and other items involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

B. Material Test Reports:

1. Stone Test Reports: For stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within the previous three years.

2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs experienced stone masons and stone fitters.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.
 1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.
- C. 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 stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than seven days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.8 COORDINATION

A. Advise installers of adjacent Work about specific requirements for placement of reinforcement, veneer anchors, flashing, and similar items to be built into stone masonry.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Stone: Obtain stone, from single quarry, with resources to provide materials of consistent quality in appearance and physical properties.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

2.2 LIMESTONE

A. Material Standard: Comply with ASTM C568/C568M.

B. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.

1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

1. Manufacturers: Subject to compliance with requirements, :

- a. Holcim (US) Inc
- b. Lafarge North America Inc.
- c. Lehigh Hanson; Heidelberg
- d. Cement Group
- e. Mutual Materials Co.

D. Aggregate: ASTM C144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.

E. Water: Potable.

2.4 VENEER ANCHORS

A. Materials:

1. Stainless Steel Wire: ASTM A580/A580M, Type 316.

B. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.

C. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Masonry-Veneer Anchors; Single-Barrel Screw with Double-Pintle Wingnut: Self-drilling, single-barrel screw with wingnut head designed to receive double-pintle wire tie. Screw has a smooth barrel the same thickness as insulation with factory-installed gasketed washer to seal at face of insulation and sheathing, and a coating to reduce thermal conductivity.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Hohmann & Barnard, Inc. Thermal 2-Seal Wing Nut Anchor or comparable product by one of the following:

- 1) Heckmann Building Products, Inc.

2.5 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a

polyester-reinforced ethylene interpolymer alloy as follows:

- a. Manufacturers: Subject to compliance with requirements.
 - 1) Hohmann & Barnard, Inc
 - 2) Wire-Bond
- b. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch- thick coating of rubberized-asphalt adhesive.
 - 1) Color: White.
- c. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- B. Weep/Vent Products: Use one of the following unless otherwise indicated:
 1. Round Plastic Tubing: Medium-density polyethylene, 3/8-inch OD by thickness of stone masonry.

2.7 FABRICATION

- A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.
 1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 2. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
- B. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Stone Masonry" Article.
- C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.
- D. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
 1. Clean sawed backs of stone to remove rust stains and iron particles.
- E. Thickness of Stone: Provide thickness indicated, but not less than the following:

1. Thickness: 4 inches plus or minus.

F. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples.

1. Finish: Rock face (pitched face).

2.8 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride.

2. Use Portland cement-lime mortar unless otherwise indicated.

3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Stone Masonry: Comply with ASTM C270, Proportion Specification.

1. Mortar for Setting Stone: Type N.

2. Mortar for Pointing Stone: Type N.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.

B. Examine wall framing, sheathing, and weather-resistant sheathing paper to verify that stud locations are suitable for spacing of veneer anchors and that installation will result in a weatherproof covering.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Accurately mark stud centerlines on face of weather-resistant sheathing paper before beginning stone installation.
- B. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 INSTALLATION OF STONE MASONRY

- A. Perform necessary field cutting and trimming as stone is set.
 - 1. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange stones in uncoursed rubble pattern with joint widths within tolerances indicated. Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical.
- D. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
- E. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place.
- F. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
- G. Install steel lintels where indicated. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.
- H. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 3/8 inch at narrowest points or more than 5/8 inch at widest points.
- I. Provide sealant joints of widths and at locations indicated.
 - 1. Keep sealant joints free of mortar and other rigid materials.
 - 2. Sealant joints are specified in Section 079200 "Joint Sealants."

- J. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
 - 1. At stud-framed walls, extend flashing through stone masonry, up sheathing face at least 8 inches, and behind weather barrier.
 - 2. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end.
 - 3. At sills, extend flashing not less than 4 inches at ends.
 - 4. At ends of head and sill flashing, turn up not less than 2 inches to form end dams.
 - 5. Install metal drip edges beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face and adhere flexible flashing to top of metal drip edge.

- K. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.
 - 1. Use round plastic tubing to form weep holes.
 - 2. Space weep holes formed from plastic tubing 16 inches o.c.
 - 3. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

- L. Install vents in head joints at top of each continuous cavity at spacing indicated. Use round plastic tubing to form vents.
 - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

- M. Coat limestone with cementitious dampproofing as follows:
 - 1. Stone at Grade: Beds, joints, and back surfaces to at least 12 inches above finish-grade elevations.
 - 2. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.
 - 3. Allow cementitious dampproofing formulations to cure before setting dampproofed stone. Do not damage or remove dampproofing in the course of handling and setting stone.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet,

3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.
- D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.
- E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.
- F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.5 INSTALLATION OF ANCHORED STONE MASONRY

- A. Anchor stone masonry to stud framing with adjustable, screw-attached veneer anchors unless otherwise indicated. Fasten anchors through sheathing to framing with two screws.
- B. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.
- C. Space anchors to provide not less than one anchor per 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.
- D. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.
- E. Provide 1-inch cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of mortar droppings and debris.
 - 1. Slope beds toward cavity to minimize mortar protrusions into cavity.
- F. Rake out joints for pointing with mortar to depth of not less than 1/2 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 POINTING

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is

formed.

- B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
 - 1. Joint Profile: Smooth, flat face slightly below edges of stone.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace stone masonry of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
 - 2. Defective joints.
 - 3. Stone masonry not matching approved samples and mockups.
 - 4. Stone masonry not complying with other requirements indicated.
- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
 - 3. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
 - 4. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.8 EXCESS MATERIALS AND WASTE

- A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 044313.13

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SECTION 05 1200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

When the information in this Specification Section conflicts with information on the Structural Construction Drawings, the Structural Construction Drawings shall prevail.

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other steel items not defined as structural steel.

1.2 DEFINITIONS

- A. Applicable building code: Building code under which the structure is designed. Unless noted otherwise this shall refer to the latest edition, including all supplements, addendums, and updates, of the Ohio Building Code.
- B. Authority having jurisdiction (AHJ): Organization, political subdivision, office or individual charged with the responsibility of administering and enforcing the provisions of the applicable building code.
- C. Engineer of record (EOR): Licensed professional responsible for sealing the structural design drawings and specifications.
- D. Nondestructive testing (NDT): Inspection procedure wherein no material is destroyed and the integrity of the material or component is not affected
- E. Quality Assurance (QA): Monitoring and inspection tasks performed by an agency or firm other than the fabricator or erector to ensure that the material provided and work performed by the fabricator and erector meet the requirements of the approved construction documents and referenced standards. Quality assurance includes those tasks designated "special inspection" by the applicable building code.
- F. Quality Assurance Inspector (QAI): Individual designated to provide quality assurance inspection for the work being performed.
- G. Quality Assurance Plan (QAP): Program in which the agency or firm responsible for quality assurance maintains detailed monitoring and inspection procedures to ensure conformance with the approved construction documents and referenced standards.
- H. Quality Control (QC): Controls and inspections implemented by the fabricator or erector, as applicable, to ensure that the material provided and work performed meet the requirements of the approved construction documents and referenced standards.
- I. Quality Control Inspector (QCI): Individual designated to perform quality control inspection tasks for the work being performed.

- J. Quality Control Program (QCP): Program in which the fabricator or erector, as applicable, maintains detailed fabrication or erection and inspection procedures to ensure conformance with the approved design drawings, specifications and referenced standards.
- K. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303-10, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- B. American Welding Society (AWS):
 - 1. Structural Welding Code – Steel (D1.1)
- C. American Institute of Steel Construction (AISC)
 - 1. AISC 303-10 "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC 360-10 "Specification for Structural Steel Buildings."

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

- A. A pre-installation meeting with the Contractor, Steel Erector, Special Inspector and the Registered Design Professional is required.
 - 1. Meeting shall be held at the job site trailer or other mutually agreed upon location.
 - 2. Contact Registered Design Professional at least two (2) weeks prior to steel installation to arrange meeting date.
 - 3. An approved Structural Steel Submittal Package shall be completed prior to arrangement of pre-installation meeting.

1.6 ACTION SUBMITTALS

- A. Shop Drawings: The fabricator or erector shall submit shop and erection drawings for review by the engineer of record (EOR), in accordance with Section 4 of the Code of Standard Practice, prior to fabrication. Drawings shall include the following:
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include Embedment Drawings for steel elements embedded in masonry or concrete.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 5. Erection Drawings
- B. One (1) hardcopy and one (1) electronic copy (in PDF format) for the structural steel shop drawings shall be submitted for review. The hardcopy of the structural steel shop drawings will be redmarked by SMA. One (1) redmarked hardcopy will be retained by SMA as an office copy. One (1) electronic copy of this redmarked set will be submitted as the approved set. No allowance has been made for redmarking a quantity of hardcopies greater than that noted above. Fees for in-house duplication of redmarks on printed hardcopies may be an Additional Service and invoiced at an hourly rate using Shell + Meyer's Standard Rate Schedule
- C. The fee to use Shell + Meyer's drawings to develop structural shop drawings is \$50.00 per sheet requested. The fee is charged directly to the sub-contractor who requests the files.
- D. Submittals requiring more than TWO (2) reviews by SMA resulting from errors and omissions of the supplier's detailer will be an Additional Service and invoiced at an hourly rate. An invoice for these services will be attached to the final approved set of shop drawings.
- E. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs) for Partial Joint Penetration (PJP), Complete Joint Penetration (CJP), and flare bevel groove welds: Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
 2. Electrode manufacturer and trade name.
- F. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the AHJ stating that the materials supplied and work performed by the fabricator are in accordance with the construction documents.
- G. At completion of erection, the approved erector shall submit a certificate of compliance to the AHJ stating that the materials supplied and work performed by the erector are in accordance with the construction documents.

1.7 INFORMATIONAL SUBMITTALS

- A. The following documents shall be available in electronic or printed form for review by the EOR prior to fabrication or erection, as applicable, unless otherwise required in the contract documents to be submitted:
1. For main structural steel elements, copies of material test reports in accordance with AISC 360, Section A3.1.
 2. For fasteners, copies of manufacturer's certifications in accordance with AISC 360, Section A3.3.
 3. For anchor rods and threaded rods, copies of material test reports in accordance with AISC 360, Section A3.4.
 4. For welding consumables, copies of manufacturer's certifications in accordance with AISC 360, Section A3.5.

5. For headed stud anchors, copies of manufacturer's certifications in accordance with AISC 360, Section A3.6.
6. Manufacturer's product data sheets or catalog data for welding filler metals and fluxes to be used. The data sheets shall describe the product, limitations of use, recommended or typical welding parameters, and storage and exposure requirements, including baking, if applicable.
7. Welding procedure specifications (WPSs).
8. Procedure qualification records (PQRs) for WPSs that are not prequalified in accordance with AWS D1.1/D1.1M or AWS D1.3/D1.3M, as applicable.
9. Welding personnel performance qualification records (WPQR) and continuity records.
10. Fabricator's or erector's, as applicable, written quality control manual that shall include, as a minimum:
 - a. Material control procedures
 - b. Inspection procedures
 - c. Nonconformance procedures
11. Fabricator's or erector's, as applicable, QC inspector qualifications.
12. Field quality-control and special inspection reports.

1.8 QUALITY CONTROL

- A. Quality control (QC) as referenced in this Specification shall be provided by the fabricator and erector.
- B. Nondestructive testing (NDT) shall be performed by the agency or firm responsible for Quality Assurance
- C. Fabricator Qualifications:
 1. 5 years minimum experience
 2. A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD: For Installer.
 3. As an alternative to being AISC Certified, the Special Inspector shall be required to provide Continuous Inspection during fabrication on-site. Owner shall approve the additional inspection fees for this service.
 - a. The attached form at the end of this specification section "Delegated Inspection of non-AISC Certified Steel Fabricators, Certificate of Compliance" shall be completed when using Non-AISC Certified Fabricators.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- E. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303-10 "Code of Standard Practice for Steel Buildings and Bridges."
 2. AISC 360-10 "Specification for Structural Steel Buildings.", including Chapter N "Quality Control and Quality Assurance".
 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- F. Quality Control Inspector Qualifications:
 1. Quality control (QC) welding inspection personnel shall be qualified to the satisfaction of the fabricator's or erector's QC program, as applicable, and in accordance with either of the following:

- a. Associate welding inspectors (AWI) or higher as defined in AWS B5.1, Standard for the Qualification of Welding Inspectors, or
- b. Qualified under the provisions of AWS D1.1/D1.1M sub clause 6.1.4
- 2. QC bolting inspection personnel shall be qualified on the basis of documented training and experience in structural bolting inspection.
- G. The fabricator and erector shall establish and maintain quality control procedures and perform inspections to ensure that their work is performed in accordance with this Specification and the construction documents.

1.9 QUALITY ASSURANCE

- A. Quality assurance (QA) as specified in this section shall be provided by the Qualified Testing Agency.
- B. Quality Assurance Inspector Qualifications
 - 1. Quality assurance (QA) welding inspectors shall be qualified to the satisfaction of the QA agency's written practice, and in accordance with either of the following:
 - a. Welding inspectors (WIs) or senior welding inspectors (SWIs), as defined in AWS B5.1, Standard for the Qualification of Welding Inspectors, except associate welding inspectors (AWIs) are permitted to be used under the direct supervision of WIs, who are on the premises and available when weld inspection is being conducted, or
 - b. Qualified under the provisions of AWS D1.1/D1.1M, sub clause 6.1.4
 - 2. QA bolting inspection personnel shall be qualified on the basis of documented training and experience in structural bolting inspection.
- C. NDT Personnel Qualifications
 - 1. Nondestructive testing personnel, for NDT other than visual, shall be qualified in accordance with their employer's written practice, which shall meet or exceed the criteria of AWS D1.1/D1.1M Structural Welding Code—Steel, sub clause 6.14.6, and:
 - a. American Society for Nondestructive Testing (ASNT) SNT-TC-1A, Recommended Practice for the Qualification and Certification of Nondestructive Testing Personnel, or
 - b. ASNT CP-189, Standard for the Qualification and Certification of Nondestructive Testing Personnel

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.

3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
 1. Select and complete connections using schematic details indicated and AISC 360.
 2. Use Allowable Stress Design; data are given at service-load level.

2.2 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
 1. W-Shapes: 60 percent.
 2. Channels, Angles: 60 percent.
 3. Plate and Bar: 25 percent.
 4. Cold-Formed Hollow Structural Sections: 25 percent.
 5. Steel Pipe: 25 percent.
 6. All Other Steel Materials: 25 percent.
- B. W-Shapes: ASTM A 992.
- C. Channels, Angles, M-Shapes: ASTM A 36.
- D. Plate and Bar: ASTM A 36.
- E. Hollow Structural Sections: ASTM A 1085, structural tubing.
- F. Steel Pipe: ASTM A 53, Type E or Type S, Grade B.
- G. Welding Electrodes:
 1. Use E70XX electrode unless noted otherwise.
 2. Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 1. Use as default bolt unless noted otherwise.
 2. Finish: Plain.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; all with plain finish.
 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- C. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.
- D. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts.
 1. Finish: Hot-dip or mechanically deposited zinc coating.
 2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.
- E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- F. Unheaded Anchor Rods: ASTM F 1554, Grade 36, U.N.O.
 1. Configuration: Straight.
 2. Nuts: ASTM A 563 heavy-hex carbon steel.
 3. Plate Washers: ASTM A 36 carbon steel.
 4. Washers: ASTM F 436, Type 1, hardened carbon steel.
 5. Finish: Plain.
- G. Threaded Rods: ASTM A 36.
 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 2. Washers: ASTM F 436, Type 1, hardened carbon steel.
 3. Finish: Plain.
- H. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- J. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.4 PRIMER

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- C. Galvanizing Repair Paint: MPI#18, MPI#19, ASTM A780, or SSPC-Paint 20.

2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 1. Camber structural-steel members where indicated.

2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."
- F. Install headed studs on all structural steel beams supporting Concrete Masonry Units directly on the beam's top flange.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
- H. Closure Plates: Provide minimum 1/4 inch closure plates at all Hollow Structural Steel tube ends, U.N.O. on plans.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Pretensioned.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Surfaces of high-strength bolted, slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces.
 6. Surfaces enclosed in interior construction.

- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

- A. Material identification procedures shall comply with the requirements of Section 6.1 of the Code of Standard Practice, and shall be monitored by the fabricator's quality control inspector (QCI).
- B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: In addition to visual inspection, shop-welded connections will be tested according to AWS D1.1 and the following inspection procedures:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.

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.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 COORDINATION

- A. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

3.4 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and 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.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.5 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to 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 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.
 - 3. Remove backing bars exposed to view, back gouge, and grind welds smooth.

3.6 FIELD QUALITY CONTROL AND QUALITY ASSURANCE

- A. Inspection: Owner will engage a qualified testing agency to perform the following inspections:
- B. Inspection of Welding
 - 1. Observation of welding operations and visual inspection of in-process and completed welds shall be the primary method to confirm that the materials, procedures and workmanship are in conformance with the construction documents. For structural steel, all provisions of AWS D1.1/D1.1M Structural Welding Code—Steel for statically loaded structures shall apply.
- C. Inspection Tasks Prior to Welding
 - 1. Welding procedure specifications (WPSs) available
 - 2. Manufacturer certifications for welding consumables available
 - 3. Material identification (type/grade)
 - 4. Welder identification system
 - a. The fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. Stamps, if used, shall be the low-stress type.
 - 5. Fit-up of groove welds (including joint geometry)
 - a. Joint preparation
 - b. Dimensions (alignment, root opening, root face, bevel)
 - c. Cleanliness (condition of steel surfaces)
 - d. Tacking (tack weld quality and location)
 - e. Backing type and fit (if applicable)
 - 6. Configuration and finish of access holes
 - 7. Fit-up of fillet welds
 - a. Dimensions (alignment, gaps at root)
 - b. Cleanliness (condition of steel surfaces)
 - c. Tacking (tack weld quality and location)
 - 8. Check welding equipment
- D. Inspection Tasks During Welding
 - 1. Use of qualified welders
 - 2. Control and handling of welding consumables

- a. Packaging
 - b. Exposure control
 3. No welding over cracked tack welds
 4. Environmental conditions
 - a. Wind speed within limits
 - b. Precipitation and temperature
 5. WPS followed
 - a. Settings on welding equipment
 - b. Travel speed
 - c. Selected welding materials
 - d. Shielding gas type/flow rate
 - e. Preheat applied
 - f. Interpass temperature maintained (min./max.)
 - g. Proper position (F, V, H, OH)
 6. Welding techniques
 - a. Interpass and final cleaning
 - b. Each pass within profile limitations
 - c. Each pass meets quality requirements
- E. Inspection Tasks After Welding
 1. Welds cleaned
 2. Size, length and location of welds
 3. Welds meet visual acceptance criteria
 - a. Crack prohibition
 - b. Weld/base-metal fusion
 - c. Crater cross section
 - d. Weld profiles
 - e. Weld size
 - f. Undercut
 - g. Porosity
 4. Arc strikes
 5. k-area
 - a. When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks within 3 inches of the weld.
 6. Backing removed and weld tabs removed (if required)
 7. Repair activities
 8. Document acceptance or rejection of welded joint or member
- F. Nondestructive Testing of Welded Joints
 1. Procedures
 - a. Ultrasonic testing (UT), magnetic particle testing (MT), penetrant testing (PT) and radiographic testing (RT), where required, shall be performed by QA in accordance with AWS D1.1/D1.1M. Acceptance criteria shall be in accordance with AWS D1.1/D1.1M for statically loaded structures, unless otherwise designated in the design drawings or project specifications.
 2. CJP Groove Weld NDT
 - a. UT shall be performed by QA on all CJP groove welds.
 3. Access Hole NDT

- a. Thermally cut surfaces of access holes shall be tested by QA using MT or PT, when the flange thickness exceeds 2 inches for rolled shapes, or when the web thickness exceeds 2 inches for built-up shapes. Any crack shall be deemed unacceptable regardless of size or location.
4. Welded Joints Subjected to Fatigue
 - a. Welded joints in the following members require weld soundness to be established by radiographic or ultrasonic inspection and shall be tested by QA as prescribed. Reduction in the rate of UT is prohibited:
 - 1) Flagpoles / Sign Posts
 - 2) Equipment Support Bases
 - 3) Elevator machine beams
 - 4) Monorails / Conveyors
5. Documentation
 - a. All NDT performed shall be documented.
 - b. For shop fabrication, the NDT report shall identify the tested weld by piece mark and location in the piece.
 - c. For field work, the NDT report shall identify the tested weld by location in the structure, piece mark, and location in the piece. When a weld is rejected on the basis of NDT, the NDT record shall indicate the location of the defect and the basis of rejection.
- G. Inspection of High-Strength Bolting
 1. Observation of bolting operations shall be the primary method used to confirm that the materials, procedures and workmanship incorporated in construction are in conformance with the construction documents and the provisions of the RCSC Specification.
 - a. For snug-tight joints, pre-installation verification testing and monitoring of the installation procedures, as specified below, are not applicable. The QAI need not be present during the installation of fasteners in snug-tight joints.
 2. For pretensioned joints and slip-critical joints, when the installer is using the turn-of-nut method with matchmarking techniques, the direct-tension-indicator method, or the twist-off-type tension control bolt method, monitoring of bolt pretensioning procedures shall be as specified below. The QAI need not be present during the installation of fasteners when these methods are used by the installer.
 3. For pretensioned joints and slip-critical joints, when the installer is using the calibrated wrench method or the turn-of-nut method without matchmarking, monitoring of bolt pretensioning procedures shall be as specified below. The QCI and QAI shall be engaged in their assigned inspection duties during installation of fasteners when these methods are used by the installer.
 4. As a minimum, bolting inspection tasks shall be in accordance with the tasks listed below.
- H. Inspection Tasks Prior to Bolting
 1. Manufacturer's certifications available for fastener materials
 2. Fasteners marked in accordance with ASTM requirements
 3. Proper fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane)
 4. Proper bolting procedure selected for joint detail

5. Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements
 6. Pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used
 7. Proper storage provided for bolts, nuts, washers and other fastener components
- I. Inspection Tasks During Bolting
1. Fastener assemblies, of suitable condition, placed in all holes and washers (if required) are positioned as required
 2. Joint brought to the snug-tight condition prior to the pretensioning operation
 3. Fastener component not turned by the wrench prevented from rotating
 4. Fasteners are pretensioned in accordance with the RCSC Specification, progressing systematically from the most rigid point toward the free edges
- J. Inspection Tasks After Bolting
1. Document acceptance or rejection of bolted connections
- K. Other Inspection Tasks
1. The fabricator's QCI shall inspect the fabricated steel to verify compliance with the details shown on the shop drawings, such as proper application of joint details at each connection.
 2. The erector's QCI shall inspect the erected steel frame to verify compliance with the details shown on the erection drawings, such as braces, stiffeners, member locations and proper application of joint details at each connection.
 3. The QAI shall be on the premises for inspection during the placement of anchor rods and other embedments supporting structural steel for compliance with the construction documents.
 - a. As a minimum, the diameter, grade, type and length of the anchor rod or embedded item, and the extent or depth of embedment into the concrete, shall be verified prior to placement of concrete.
 4. The QAI shall inspect the fabricated steel or erected steel frame, as appropriate, to verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations and proper application of joint details at each connection.
- L. NONCONFORMING MATERIAL AND WORKMANSHIP
1. Identification and rejection of material or workmanship that is not in conformance with the construction documents shall be permitted at any time during the progress of the work. However, this provision shall not relieve the owner or the inspector of the obligation for timely, in-sequence inspections.
 2. Nonconforming material and workmanship shall be brought to the immediate attention of the fabricator or erector, as applicable.
 3. Nonconforming material or workmanship shall be brought into conformance, or made suitable for its intended purpose as determined by the engineer of record.
 4. Concurrent with the submittal of such reports to the AHJ, EOR or owner, the QA agency shall submit to the fabricator and erector:
 - a. Nonconformance reports
 - b. Reports of repair, replacement or acceptance of nonconforming items

3.7 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 051200

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SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

When the information in this Specification Section conflicts with information on the Structural Construction Drawings, the Structural Construction Drawings shall prevail.

1.1 SUMMARY

- A. Section Includes:
 - 1. K-series steel joists.
 - 2. K-series steel joist substitutes.
 - 3. Joist accessories.
- B. Related Requirements:
 - 1. Section 042200 "Concrete Unit Masonry" for installing bearing plates in unit masonry.

1.2 DEFINITIONS

- A. Add-Load: A single vertical concentrated load which occurs at any one panel point along the joist chord. This load is in addition to any other gravity loads specified.
- B. Bend-Check Load: A vertical concentrated load used to design the joist chord for the additional bending stresses resulting from this load being applied at any location between the joist panel points. This load shall already be accounted for in the specified joist designation load, uniform load, or Add-load and is used only for the additional bending check in the chord and does not contribute to the overall axial forces within the joist.
- C. Construction Loads: See Federal Register, Department of Labor, Occupational Safety and Health Administration (2001), 29 CFR Part 1926 Safety Standards for Steel Erection; Final Rule, §1926.757 Open Web Steel Joists - January 18, 2001, Washington, D.C. for definition of "construction load".
- D. Contractor: Owner of a Building, or the person who contracts with the Owner, who constructs the Building in accordance with the Construction Documents and the Steel Joist Submittal Package. The term "Contractor" shall include those subcontractors who have a direct contract with the Contractor to construct all or a portion of the construction.
- E. Framing Structural System: Completed combination of Structural Elements, joists, connections and other systems, which serve to support the Building's self-weight and the specified loads.
- F. Joist Design Engineer: Person who is licensed to practice engineering in the State of Ohio and who supervises the preparation of the joist shop drawings.
- G. Joist Installer: The Contractor, or subcontractor, responsible for the safe lifting/hoisting and installation of the joists, including the installation of all temporary and permanent restraints and bracing.
- H. K- and LH- series steel joists: Open web, load-carrying members utilizing hot-rolled or cold-formed steel, including cold-formed steel whose yield strength has been attained by cold working, suitable for the direct support of floors and roof slabs or deck.

- I. Placement Plans. Drawings that are prepared depicting the interpretation of the contract documents requirements for the material to be supplied by the joist manufacturer. A unique piece mark number shall be shown for the individual placement of the steel joists and accessories along with sections that describe the end bearing conditions and minimum attachment required so that material is placed in the proper location in the field.
- J. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- K. Registered Design Professional (RDP): Architect or Structural Engineer, who is licensed to practice their respective design profession and who contracts with the Owner for the design of the Framing Structural System and who is responsible for the preparation of the Construction Documents.
- L. Special Joists: Steel joists requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications." These joists are noted on plan with an "SP" notation.

1.3 REFERENCES

- A. Steel Joist Institute (SJI)
 - 1. "Standard Specifications for Open Web Steel Joists, K-Series", (SJI-K-2010)
 - 2. "Code of Standard Practice for Steel Joists and Joist Girders", (SJI-COSP-2010)

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.
- B. Shop Drawings (Placement Plans): Show fabrication and installation details for joists as outlined below. Joist manufacturer shall not modify the joist layout shown on the Structural Construction Documents without first consulting with and getting approval from the RDP. Any modification requests shall be made during the bidding period or may be subject to additional engineering fees if submitted during the shop drawing review process.
 - 1. Include layout, designation, number, type, location, and spacing of joists.
 - 2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
 - 3. Indicate locations and details of bearing plates to be embedded in other construction.
 - 4. Details shall be specific to the Project's requirements.
 - 5. Steel joist placement plans do not require the seal and signature of the Joist Design Engineer
- C. Joist Manufacturer shall submit the Shop Drawings to the Registered Design Professional for review and approval prior to the manufacturing of joists.
- D. One (1) hardcopy and one (1) electronic copy (in PDF format) for the structural steel joist shop drawings shall be submitted for review. The hardcopy of the structural steel joist shop drawings will be redmarked by SMA. One (1) redmarked hardcopy will be retained by SMA as an office copy. One (1) electronic copy of this redmarked set will be submitted as the approved set. No allowance has been made for redmarking a quantity of hardcopies greater than that noted above. Fees for in-house duplication of redmarks on printed

hardcopies may be an Additional Service and invoiced at an hourly rate using Shell + Meyer's Standard Rate Schedule

- E. The fee to use Shell + Meyer's drawings to develop structural shop drawings is \$50.00 per sheet requested. The fee is charged directly to the sub-contractor who requests the files.
- F. Submittals requiring more than TWO (2) reviews by SMA resulting from errors and omissions of the supplier's detailer will be an Additional Service and invoiced at an hourly rate. An invoice for these services will be attached to the final approved set of shop drawings.
- G. The Contractor shall ensure the Joist Manufacturer has the latest issue of the Contract Documents, including but not limited to Structural Drawings, Addendums, Bulletins, and Specifications.
- H. The Contractor shall ensure that dimensional field modifications of the supporting structure are conveyed to the joist manufacturer prior to the joist installation.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Manufacturer certificates.
- C. Comprehensive engineering analysis of Special Joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing Special Joists to comply with performance requirements and for those items listed under the 'Delegated Design Submittal' of this Specification.
- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

- A. Deliver steel bearing plates to be built into masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Joist manufacturer shall design joists for additional loads at locations shown on the Structural Drawings

- B. Structural Performance: Provide Special Joists and connections capable of withstanding design loads indicated.
 - 1. Use ASD; data are given at service-load level.
 - 2. Mechanical units
 - 3. Axial loads:
 - a. Refer to plans for axial loads need to be incorporated into the joist design.
 - 4. Moments: No additional moments need to be incorporated into the joist design.
 - 5. Structural bracing loads: Refer to plans and sections for bracing loads that need to be incorporated into the joist design.
 - 6. The following “Bend-Check” Load
 - a. Design for additional bending stresses resulting from a 200 lb. concentrated load located at any location along both top and bottom chord.
 - 7. Design Special Joists to withstand design loads with load deflections no greater than the following:
 - a. Floor Joists: Vertical Live Load deflection of 1/360 of the span.
- C. Delegated-Design Submittal:
 - 1. Joist Design Engineer shall check all joists for the following:
 - a. Design joist for a 250 lb. concentrated load at any location along the bottom chord.
 - b. The following “Bend-Check” Load
 - 1) Design for additional bending stresses resulting from a 250 lb. concentrated load located at any location along both top and bottom chord.
 - 2) Increase “Bend Check” Load to 500 lb. over Mechanical Rooms
 - 2. For Special Joists indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the Joist Design Engineer responsible for their preparation. The qualified professional engineer shall be licensed in the State of Ohio.

2.2 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to “Standard Specifications for Open Web Steel Joists, K-Series” in SJI’s “Specifications,” with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist End Bearing Depth = 2 1/2 inches.
- B. Top chord angles shall be fabricated from structural steel conforming to one of the following:
 - 1. ASTM A36
 - 2. ASTM A992
- C. Top chord angles shall have a minimum horizontal leg width of 2 inches at locations where deck edges but.
- D. Steel Joist Substitutes: Manufacture according to “Standard Specifications for Open Web Steel Joists, K-Series” in SJI’s “Specifications,” with steel-angle or -channel members.
- E. Provide holes in chord members for connecting and securing other construction to joists.
- F. Top-Chord Extensions: Extend top chords of joists with SJI’s Type S top-chord extensions where indicated, complying with SJI’s “Specifications.”

- G. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- H. Camber K-series steel joists according to SJI's "Specifications." (Table 4.6-1)
- I. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.4 JOIST ACCESSORIES

- A. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.
- B. Fabricate steel bearing plates from ASTM A 36 steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.
- C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. Finish: Plain, uncoated.
- D. Welding Electrodes: Comply with AWS standards.
- E. Headers: Headers for Open Web Steel Joists, K-Series shall be furnished by the Joist Manufacturer. Such headers shall be any type standard with the Manufacturer.
- F. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.

- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications", the joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. When required, only provide welds parallel to the joist chords. Do not weld across joist chords without written authorization from the Joist Designer and the Registered Design Professional.
- E. Bolt joists to supporting steel framework using carbon-steel bolts.
- F. Bridging (General)
 - 1. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
 - 2. Bridging shall support the top and bottom chords against lateral movement during the construction period and shall hold the steel joists in the approximate position as shown on the joist placement plans.
 - 3. A single line of bottom chord bridging (Uplift Bridging) shall be provided near the first bottom chord panel points of all roof joists.
 - 4. The ends of all bridging lines terminating at walls or beams shall be anchored thereto.
 - a. A bridging terminus point shall be established before joist bridging is installed.
 - b. When permanent bridging terminus points cannot be used during erection, additional temporary bridging terminus points are required to provide stability.
- G. Bridging (Diagonal)
 - 1. When bolted diagonal erection bridging is required, the following shall apply:
 - a. The bridging shall be indicated on the joist placement plan.
 - b. The joist placement plan shall be the exclusive indicator for the proper placement of this bridging.
 - c. Shop installed bridging clips, or functional equivalents, shall be provided where the bridging bolts to the steel joist.
 - d. When two pieces of bridging are attached to the steel joist by a common bolt, the nut that secures the first piece of bridging shall not be removed from the bolt for the attachment of the second piece.
 - e. Bridging attachments shall not protrude above the top chord of the steel joists.
- H. Bearing Seat Attachments
 - 1. Ends of K-Series Joists resting on steel bearing plates on masonry or structural concrete shall be attached thereto with a minimum of two 1/8 inch fillet welds 2 inches long.
 - 2. Ends of K-Series Joists resting on steel supports shall be attached thereto with a minimum of two 1/8 inch fillet welds 2 inches long.
- I. Construction Loading

1. No Construction Loads shall be allowed on the steel joists until all bridging is installed and anchored, and all joist bearing ends are attached.
 2. During the construction period, loads placed on the steel joists shall be distributed so as not to exceed the capacity of the steel joists.
 3. No bundle of deck shall be placed on steel joists until all bridging has been installed and anchored and all joist bearing ends attached, unless the following conditions are met:
 - a. The contractor has first determined from a qualified person, as defined by OSHA, and documented in a site-specific erection plan that the structure or portion of the structure is capable of supporting the load;
 - b. The bundle of decking is placed on a minimum of 3 steel joists;
 - c. The joists supporting the bundle of decking are attached at both ends;
 - d. At least one row of bridging is installed and anchored;
 - e. The total weight of the decking does not exceed 4000 pounds; and
 - f. The edge of the decking shall be placed within 1 foot of the bearing surface of the joist end.
 4. The edge of the construction load shall be placed within 1 foot of the bearing surface of the joist end.
- J. Concentrated Loads
1. Where concentrated loads greater than 100 pounds do not occur at panel points, an extra web shall be field applied from the point of attachment to a panel point on the opposite chord.
- K. Fall Arrest System Support
1. Steel joists shall not be used as anchorage points for a fall arrest system unless written directions to do so is obtained from a “qualified person”, as defined by OSHA.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.
- B. Visually inspect field welds according to AWS D1.1/D1.1M.
- C. Visually inspect bolted connections.
- D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- E. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.4 PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
 2. Apply a compatible primer of same type as primer used on adjacent surfaces.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

When the information in this Specification Section conflicts with information on the Structural Construction Drawings, the Structural Construction Drawings shall prevail.

1.1 SUMMARY

- A. Section Includes:
 - 1. The extent of steel deck shown on the Drawings including type of deck, layout and orientation.
 - 2. Welds and mechanical fastener types, sizes and patterns.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for concrete on steel deck.
 - 2. Section 051200 "Structural Steel Framing" for structural steel of the Primary Structural System.
 - 3. Section 052100 "Steel Joist Framing" for structural steel joist framing.
 - 4. Section 055000 "Metal Fabrications" for framing deck openings and perimeter deck supports with miscellaneous steel shapes.

1.2 DEFINITIONS

- A. Terms not defined in this Specification, AISI S100 or AISI/AISC shall have the ordinary accepted meaning for the context for which they are intended.
- B. Base Material – The existing part of the work that is a base for the fastening. The structural steel or bar joist framing members in steel deck applications
- C. Button Punch – A mechanical means of connecting two pieces of sheet metal together by crimping with a special tool. Unless noted otherwise, button punching shall not be permitted.
- D. Diaphragm Deck – A decking system which is designed to carry lateral loads due to wind or seismic action in addition to gravity loads and wind uplift.
- E. Endlap – The overlap of adjacent steel deck panels at the ends of the panels (end edges perpendicular to the steel deck fluting).
- F. Fastener Pattern – The number and spacing of fasteners at each support for a steel deck panel.
- G. Interlocking Sidelap (BI Connection) – Steel deck panels having male and female side edges. The adjacent deck panel male and female edges interlock into each other when the deck is installed. The interlocks are fastened together using button punches, proprietary punch systems, welds, or screws. Unless noted otherwise, interlocking sidelaps shall not be permitted.
- H. Nestable Sidelap – Steel deck type in which the side edge of the steel deck panel contains a partial valley profile and overlaps, or "nests" on top of the side edge of the adjacent steel deck panel, which contains a full valley profile.
- I. Pullout – As related to fasteners, a failure mode that occurs when the fastener pulls out of the base steel support.

- J. Pullover – As related to fasteners, a failure mode that occurs when the steel deck panel pulls over the fastener head or washer(s).
- K. Sidelap – The side edge overlap of adjacent steel panels (side edges parallel to the steel deck panel fluting).
- L. Tack Weld – A weld of no structural significance. Used for temporary attachment of steel to the supporting frame. A weld made to hold the parts in proper alignment until the final welds are made.
- M. Uplift – Vertical load on the steel deck panels due to wind forces.

1.3 REFERENCES

- A. American Concrete Institute
 - 1. ACI 318-11, Building Code Requirements for Structural Concrete
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
 - 2. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 4. ASTM C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C. American Institute of Steel and Iron (AISI):
 - 1. AISI S100-07 w/S2-10, North American Specification for the Design of Cold-Formed Steel Structural Members, Including Supplement 2 (February 2010)
 - 2. AISI S905-08, Test Methods for Mechanically Fastened Cold-Formed Steel Connections
 - 3. AISI S907-08, Test Standard for Cantilever Test Method for Cold Formed Steel Diaphragms
- D. American National Standards Institute (ANSI)
 - 1. Safety Requirements for Powder-Actuated Fastening Systems (ANSI A10.3)
- E. American Welding Society (AWS):
 - 1. Structural Welding Code – Steel (D1.1)
 - 2. Structural Welding Code – Sheet Steel (D1.3-2008)
- F. Factory Mutual (FM):
 - 1. Building Materials Approval Directory
 - 2. Standard Class No. 4450 – Class I Insulated Steel Roof Decks
- G. International Code Council Evaluation Service (ICC-ES):
 - 1. Acceptance Criteria for Steel Deck Roof and Floor Systems (AC43)
 - 2. Steel Deck Diaphragms Attached with Hilti X-HSN 24 or X-ENP-19 L15 Power-Driven Fasteners and Hilti S-SLC 01 M HWH and S-SLC 02 M HWH Sidelap Connectors (ESR-2776)
 - 3. Bare Steel Deck and Concrete-Filled Steel Deck Diaphragms Attached with Hilti X-ENP-19 L15 or X-HSN 24 Fasteners (ESR-2197)
- H. Steel Deck Institute (SDI):
 - 1. "Code of Standard Practice" COSP-2014

2. "Standard for Steel Roof Deck" RD-2010
3. "Standard for Non-Composite Steel Floor Deck" NC-2010
4. "Standard for Composite Steel Floor Deck Slabs" C-2011
5. "Roof Deck Design Manual" RDDM-2013 – First Edition
6. "Floor Deck Design Manual" FDDM-2014 – First Edition
7. "Diaphragm Design Manual – Design Manual for Composite Decks, Form Decks and Roof Decks", 3rd Edition and Appendix V (Including 2006 and 2013 Addendums)
8. "Manual of Construction with Steel Deck", Second Edition (MOC2) – 2006
9. "Standard for Quality Control and Quality Assurance for the Installation of Steel Deck", as modified by Table C-1 contained in the Commentary to that Standard, QA/QC – 2011
10. Standard Practice Details, SPD-2 – 2001
11. Deck Damage and Penetrations, DDP – 2000
- I. Underwriters Laboratories (UL):
 1. Roofing Materials and Systems Directory
 2. Fire Resistance Directory, Volume 1
 3. UL Standard 580 – Tests for Uplift Resistance of Roof Assemblies
- J. Wire Reinforcement Institute (WRI):
 1. Manual of Standard Practice, Eighth Edition, 2010

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
 1. Deck layout and orientation, supporting steel framing and supports with dimensions and section details.
 2. Deck type and profile, dimensions, supports, projections, and cut deck openings.
 3. Reinforcing channels, pans, special jointing, accessories, and attachments to other construction.
 4. Welds and mechanical fastener types, sizes and patterns.
 5. Sidelap connector types, sizes and patterns.
 6. Accessory details.

1.5 INFORMATIONAL SUBMITTALS

- A. The following documents shall be made available in electronic form to the Designer for review prior to installation of the deck.
 1. Manufacturer's Published Installation Instructions and product data sheets, catalogue data, or independent evaluation reports (ICC-ESR) for mechanical fasteners.
 2. Product Certificates: For each type of steel deck.
 3. Manufacturer's data for welding consumables.
 4. Manufacturer's product data sheets or catalog data for welding filler metals and fluxes to be used. The data sheets shall describe the product, limitations of use, recommended or typical welding parameters, and storage and exposure requirements, including baking, if applicable.
 5. Welding Procedure Specifications (WPS.)

6. Procedure Qualification Records (PQR) for WPS that are not prequalified in accordance with AWS D1.1 or AWS D1.3, as applicable.
7. Welding Personnel Performance Qualification Records (WPQR)
8. Installer's Quality Control Program (QCP)
9. Installer's QC Inspector qualifications
10. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Quality Control and Quality Assurance for steel deck installation shall be in accordance with SDI QA/QC 2011, "Standard for Quality Control and Quality Assurance for the Installation of Steel Deck", as modified by Table C-1 contained in the Commentary to that Standard.
- B. Manufacturer Qualifications:
 1. Steel Roof Deck Manufacturer: Member producer of SDI.
 2. Mechanical Fastener Manufacturer: Member producer of SDI and ISO 9001 accredited for manufacturing quality control.
- C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- D. Welding Qualifications: All steel roof deck welders AWS certified for welding of sheet steel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- E. Mechanical Fastener Installers: All mechanical fastener installers certified or licensed by the fastener and tool system manufacturer on the project site in accordance with ANSI A10.3 requirements. Certification or licensing includes all training necessary for proper tool operation, fastener selection, maintenance and troubleshooting.
- F. Comply with all manufacturer catalog and carton installation instructions, product data and technical bulletins.
- G. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.
- H. Pre-Installation Meeting:
 1. Installer shall demonstrate workmanship by conducting representative fastenings and welds at pre-installation meeting subject to guidance from mechanical fastener manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Deck:
 1. Do not rack, bend or mar steel deck sheets.
 2. Store steel deck sheets and accessories above ground and protected from free weathering with one end elevated to provide drainage.
 3. Cover with waterproof covering and ventilate to avoid condensation until final installation.
 4. Architecturally exposed steel deck sheets shall be appropriately packaged or protected to prevent damage during delivery, storage and handling.
- B. Welding Electrodes, Mechanical Fasteners, and Sidelap Connectors
 1. Store welding electrodes, mechanical fasteners and powder-actuated cartridges in original packages in a cool, dry location until final installation.

2. Comply with all project and national safety regulations regarding handling of welding equipment and powder-actuated fastening systems.
- C. Acoustical Batts: When open rib acoustical deck is provided, any sound absorbing acoustical batts provided shall be stored at the jobsite in such a manner as to ensure protection until installation. If acoustical batts become wet, they shall be allowed to thoroughly dry without being compressed before installation or shall be replaced if contaminated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Substitution requests shall be submitted with the following information indicating the values meet or exceed the weld or fastener capacity of that specified in the Structural Drawings.
 1. Weld and mechanical fastener performance data including ultimate tension and shear loads and flexibility factors.
- C. Refer to Part 3, "Concrete Placement" Article of this Section for design construction live loads.

2.2 ACCEPTABLE MANUFACTURERS

- A. Steel Deck: 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. Consolidated Systems, Inc.; Metal Dek Group.
 2. Epic Metals Corporation.
 3. New Millennium Building Systems, LLC.
 4. Nucor Corp.; Vulcraft Group.
 5. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
- B. Mechanical Fasteners
 1. Hilti, Inc.
 2. ITW Buildex (limited to use in base material of 0.0346 inches or less)
 3. Pneutek
 4. Other approved alternative
- C. Sidelap Connectors
 1. Elco
 2. Hilti, Inc.
 3. ITW Buildex
 4. Other approved alternative

2.3 MATERIALS

- A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 50, G60 zinc coating.
 2. Deck Profile: As indicated.
 3. Profile Depth: As indicated.
 4. Design Uncoated-Steel Thickness: As indicated.
 5. Span Condition: Triple span or more.
 6. Acoustical Perforations: Cellular deck units with manufacturer's standard perforated flat-bottom plate welded to ribbed deck.
 7. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip glass or mineral fiber.
 - a. Factory install sound-absorbing insulation into cells of cellular deck above the following rooms: Break Room L160, Mechanical Room L162, and Community Rooms L163, 164 165, and rooms L167, L168, L169, L170, L171A, L171B.
 - b. 8. Acoustical Performance: NRC .65, tested according to ASTM C423
- B. Welds and Mechanical Fasteners:
1. Welds:
 - a. Material: Electric shielded arc process using minimum E60XX electrodes in accordance with AWS D1.3 procedures
 - b. Weld Quality: All welds uniform size and appearance and free of pinholes, porosity, undercutting or other defects.
 - c. Weld Size: Minimum 5/8 in. effective diameter
 - d. Weld Washers: Use on steel roof deck thinner than 22 gauge
 2. Mechanical Fasteners:
 - a. Material: AISI 1070 modified
 - b. Hardness: Minimum Rockwell Hardness C 54.5
 - c. Strength: Minimum tensile strength 285 ksi; minimum shear strength 175 ksi
 - d. Design and Manufacture: Knurled shank with forged ballistic point. Manufacturing process shall ensure steel ductility and prevent development of hydrogen embrittlement.
 - e. Washers:
 - 1) For steel bar joist framing: 0.472 inch steel washers
 - 2) For structural steel framing: Minimum 0.591 inch steel washers
 - f. Corrosion Resistance:
 - 1) For steel roof decks with waterproofing membrane: 5-micron zinc electroplated in accordance with ASTM B 633 SC1 Type III
 - g. Approved Types
 - 1) For use with steel bar joist and light structural steel framing supports with top chord or flange thickness 1/8 inch to 3/8 inch:
 - a) Hilti X-HSN 24 (1/8 in. up to and including 3/8 in.)
 - b) Other approved alternative.

- 2) For use with structural steel framing supports with top flange thickness 1/4 inch or thicker:
 - a) Hilti X-ENP-19 L15 (1/4 in. or thicker)
 - b) Other approved alternative.
 - 3) For use with Cold Formed Steel Framing
 - a) ITW Buildex TEKS Self Drilling Fasteners
 - b) Other approved alternative.
- C. Sidelap Connectors
1. Acceptable types of sidelap connectors:
 - a. Mechanical sidelap connectors
 - 1) Drive mechanical sidelap connectors completely through adjacent lapped roof deck sheets to achieve positive engagement of adjacent sheets with a minimum of three thread penetration.
 - 2) Material: ASTM A 510 Grade 1022
 - 3) Hardness: Minimum Vickers Surface Hardness of 450 HV0.3
 - 4) Design and Manufacture: Hex washer head undercut with reverse serrations; self-piercing or stitch point at center.
 - 5) Approved Types
 - a) Hilti S-SLC01 M HWH Sidelap Connector
 - b) Hilti S-SLC02 M HWH Sidelap Connector
 - c) ITW Buildex TEKS Self Drilling Fasteners
 - d) Other approved alternative.
 - b. Button punches shall not be used unless specifically noted.

2.4 CONCRETE

- A. Concrete and reinforcing steel placed on steel deck shall conform to ACI 318, Chapters 3, 4, and 5, except as modified in this Specification.
- B. The 28-day concrete compression strength shall not be less than 3500 psi.
- C. Admixtures containing chloride salts or other substances that are deleterious to the steel deck shall not be permitted.

2.5 TOLERANCES

- A. The minimum uncoated steel thickness as delivered to the job site shall not at any location be less than 95% of the design thickness, however lesser thicknesses shall be permitted at bends, such as corners, due to cold-forming effects.
- B. Panel length shall be no less than 1/2 inch shorter than the specified length nor greater than 1/2 inch longer than the specified length for single span. Panel length shall be no less than 1/2 inch shorter than the specified length for lapped end deck.
- C. Panel cover width shall be no less than 3/8 inch less than the specified panel width, nor more than 3/4 inch greater than the specified width.
- D. Panel camber and/or sweep shall not be greater than 1/4 inch in a 10-foot length.
- E. Panel end out of square shall not exceed 1/8 inch per foot of panel width.

2.6 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- D. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth, unless otherwise noted on the drawings.
- E. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- F. Piercing Hanger Tabs: NOT PERMITTED
- G. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.056 inch thick, with factory-punched hole of 3/8-inch minimum diameter (for weld-fastening deck with an uncoated minimum steel thickness of less than 0.028 inch).
- H. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Confirm location and elevation of supporting steel framing with the Drawings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Layout: Place steel deck sheets as shown on the Drawings ensuring bearing on supporting steel framing. Sheets shall be true and straight with horizontal deviations less than 1/4 in. in 100 feet.
- B. Marking: Mark steel deck at the centerline of supporting steel members to prevent weld burn through or mechanical fastener punch through. Use a chalk line or indelible marker.
- C. Test Fastenings:
 - 1. Welds: Perform project specific test welds prior to final installation per AWS D1.3. Test welds are considered examples of representative work.
 - 2. Mechanical fasteners: Gauge powder-actuated tool systems to the base material steel type, steel deck type and thickness prior to final installation. Confirm appropriate power regulation and powder-actuated cartridge type prior to final installation.

3.3 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

- B. Locate deck bundles to prevent overloading of supporting members.
 - 1. Deck bundles must always be placed on the steel frame near a main supporting beam at a column or wall. In no case shall the bundles be placed on unbolted frames or unattached or unbridged joists.
 - 2. The structural frame must be properly braced to receive bundles.
- C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened.
- D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- H. All OSHA, State, and Local rules for erection shall be followed.

3.4 MECHANICAL FASTENERS

- A. Fasteners shall not be installed into structural supports which are outside the acceptable limits of the manufacturers applicable test report or other documentation.
- B. Fastener edge distance shall be as required by the applicable fastener design standard or manufacturer's instructions.
- C. When the structural support thickness is less than 1/8-inch, powder actuated or pneumatically driven fasteners shall not be used unless lesser support thicknesses are permitted by applicable fastener test report or other documentation acceptable to Shell and Meyer.
- D. Screws shall have a grip range compatible with the combined thickness of the deck and supporting member.

3.5 FLOOR DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Unless otherwise indicated, weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
 - 3. Weld Washers: Install weld washers at each weld location if minimum uncoated steel thickness is less than 0.028 inch.
 - 4. Weld metal shall penetrate all layers of deck material at end laps and shall have good fusion to the supporting members.
- B. Unless otherwise noted on the Construction Drawings the following minimum deck attachments shall apply:
 - 1. Deck to Supports: Edge ribs of panels (the bottom flange of the last rib of a deck panel) shall be fastened to each point of support. Additional fasteners between edge

ribs shall be spaced an average of 12 inches apart but not more than 18 inches, unless otherwise noted on the Construction Drawings.

2. Connecting Side laps: Side laps shall be fastened at intervals not to exceed 36 inches on center, using one of the following methods:
 - a. Screws with a minimum diameter of 0.190 inches (#10 diameter).
 - b. Arc spot welds with a minimum 5/8 inch minimum visible diameter.
 - c. Minimum 1-1/2 inch long fillet weld.
 - d. Do not weld side laps of deck thinner than 0.0358 inch (20 ga.).
3. Perimeter Supports: Perimeter edges of deck units between span supports shall be fastened at intervals not to exceed 12 inches on center, using one of the following methods:
 - a. Screws with a minimum diameter of 0.210 inches (#12 diameter).
 - b. Arc spot welds with a minimum 5/8 inch minimum visible diameter.
 - c. Minimum 1-1/2 inch long fillet weld.
 - d. Powder actuated or pneumatically driven fasteners.

C. Cantilevers:

1. Side laps shall be attached at the end of the cantilever and at a maximum spacing of 12 inches on center from the cantilevered end at each support.
2. Each deck corrugation shall be fastened at both the perimeter support and the first interior support.
3. The deck shall be completely attached to the supports and at the side laps before any load is applied to the cantilever.

D. Bearing and End Laps:

1. Composite Floor Deck: End Joints: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches and intermediate bearing of 2 inches. End joints shall be butted.

E. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

F. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

G. Support shall be provided at the perimeter of all floor deck.

1. Provide L3x3x1/4 continuous angles parallel to floor deck, unless noted otherwise.
2. Provide L6x4x5/16 LLV continuous angles at perpendicular or diagonal conditions, unless noted otherwise.
3. Anchor angles to walls with Post Installed Anchors per Construction Drawings.

H. Deck bearing surfaces shall be permitted to deviate from parallel a maximum of 1:24, but not to exceed 1/16 inch.

3.6 ACCESSORY ATTACHMENT

- A. Structural accessories shall be attached to supporting structure or deck as required for transfer of forces, but not to exceed 12 inches on center.
- B. Non-structural accessories shall be attached to supporting structure or deck as required for serviceability, but not to exceed 12 inches on center.

3.7 CONCRETE PLACEMENT

- A. Verify all deck is adequately attached to the structure per the Construction Documents to prevent the deck from slipping off the supporting structure prior to placing concrete.
- B. Surfaces shall be cleaned of soil, ice, oil, standing water, and debris, including but not limited to, welding rods, stud ferrules which are broken free from the stud, and excess fasteners, prior to concrete placement.
- C. Concrete shall not be placed on a cantilevered portion of deck before concrete is placed on the adjacent span.
- D. Construction Loads
 - 1. Deck has been selected per ANSI/SDI recommendations, unless noted otherwise. Construction Live Load shall not exceed:
 - a. A uniform construction live load of 20 PSF + Weight of fresh concrete.
 - b. A uniform combined distributed construction live load, 50 PSF (On bare deck).
 - c. A concentrated construction live load per unit width of deck section; 150 pounds on a 1 foot width + Weight of fresh concrete.
- E. Method of Placement
 - 1. Concrete shall be transported and placed by hose and finished using hand tools.
 - 2. Bulk dumping of concrete using buckets, chutes, or handcarts, or the use of heavier motorized finishing equipment such as power screeds are not permitted unless the contractor has the deck evaluated for the proposed placement or finishing methods. See "Temporary Shoring" article above, if required.

3.8 DECK DAMAGE AND PENETRATIONS

- A. Round openings not shown on the erection drawings, such as those required for stacks, conduits, plumbing, vents, etc. shall be cut (and reinforced, if necessary) by the trades requiring the openings.
 - 1. A single opening of up to 6 inches in diameter may be placed in 1-1/2 inch steel roof deck.
 - a. Spacing Perpendicular to Deck Flutes: Adjacent holes perpendicular to deck flutes must be placed at least 3 feet apart, or an angle frame will be required.
 - b. Spacing Parallel to Deck Flutes: Adjacent holes parallel to deck flutes must be placed at least 12 inches apart as long as only one deck flute per sheet is being removed, or an angle frame will be required.
 - 2. Reinforce holes or dents in wide rib deck with a 20 inch square plate and attach to deck ribs with welds or screws at 8 inches on center maximum around the perimeter of the plate. Thickness of the plate shall be as follows:
 - a. Up to 6 inches in diameter: No reinforcing required.
 - b. 6 inches to 8 inches in diameter: 0.045 inch minimum plate thickness.
 - c. 8 inches to 12 inches in diameter: 0.057 inch minimum plate thickness.
 - d. Over 12 inches: Frame opening.
 - 3. Spacing of reinforced openings /dents shall be 36 inches on center minimum each way.

4. Fasteners used around openings, both framed and reinforced, shall be the same type used to attach the deck to the frame. Spacing shall not exceed 8 inches on center around the opening.
5. Openings or cut outs for Roof Sump Pans and Sump Plates shall comply with above reinforcing requirements.
- B. Trades that subsequently cut unscheduled openings through the deck shall be responsible for reinforcing these openings based on an approved and sealed engineered design and submitted to Shell and Meyer Associates, Inc. for approval.
 1. Alternatively, the contractor can independently retain Shell + Meyer to provide additional design services required to determine the reinforcement requirements around the proposed opening.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Special Inspection of Deck Placement:
 1. Confirm minimum end bearing.
 2. Confirm bearing surface tolerances comply with SDI as noted in Executions article above
- C. Special Inspection of Deck Welds:
 1. Examination and qualification of puddle and fillet welds shall be in accordance with AWS D1.3 criteria.
 2. Inspections Prior to Deck Placement
 - a. Verify compliance of materials (deck and all deck accessories) with Construction Documents, including profiles, material properties, and base metal thickness
 - b. Document acceptance or rejection of deck and deck accessories
 3. Inspections After Deck Placement
 - a. Verify compliance of deck and all deck accessories installation with Construction Documents
 - b. Document acceptance or rejection of installation of deck and deck accessories
 4. Inspection Tasks Prior to Welding
 - a. Welding Procedure Specifications (WPS) are available
 - b. Manufacturer certifications for welding consumables are available
 - c. Material identification (type and grade)
 - d. Check welding equipment
 - e. Ensure steel roof deck is clamped to the supporting steel framing.
 5. Inspection Tasks During Welding
 - a. Use of qualified welders
 - b. Control and handling of consumables
 - c. Environmental conditions (wind speed, moisture, temperature)
 - d. WPS followed
 - e. Weld metal shall penetrate all layers of deck material at end laps and shall have good fusion to the supporting members.
 6. Inspection Tasks After Welding

- a. Verify size and location of welds, including support, sidelap, and perimeter welds
 - b. Welds meet visual acceptance criteria
 - c. Verify repair activities
 - d. Document acceptance or rejection of welds
- D. Special Inspection of Mechanical Fasteners:
- 1. Inspection Tasks Prior to Mechanical Fastening
 - a. Manufacturer's Published Installation Instructions (MPII) available for mechanical fasteners
 - b. Proper tools available for fastener installation
 - c. Proper storage for mechanical fasteners
 - d. Ensure steel roof deck is clamped to the supporting steel framing.
 - 2. Inspection Tasks During Mechanical Fastening
 - a. Fasteners are positioned as required
 - b. Examination of washer condition
 - c. Fastener's are installed in accordance with MPII
 - 3. Inspection Tasks After Mechanical Fastening
 - a. Check spacing, type, and installation of *support* fasteners
 - b. Check spacing, type, and installation of *sidelap* fasteners
 - c. Check spacing, type, and installation of *perimeter* fasteners
 - d. Verify repair activities
 - e. Document acceptance or rejection of mechanical fasteners
- E. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- F. Remove and replace work that does not comply with specified requirements.
- G. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.10 PROTECTION

- A. Steel deck shall be protected against contact with materials that cause, or can be shown to cause, corrosion or other deterioration of the deck and accessories.
- B. Pressure treated wood shall not be placed in direct contact with the steel deck without installing a protective barrier between the two.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.
- D. Deck areas subject to heavy or repeated traffic, concentrated loads, impact loads, wheel loads, or other like loading, shall be adequately protected by planking or other means to avoid overloading or damage.
- E. Do not exceed construction load carrying capacity of steel roof deck sheets for type and span defined in SDI Construction Load Tables.
- F. Do not use deck units as a working platform or storage area until units are permanently attached in position.

3.11 REPAIR / RESTORATION

- A. Before placement of roof insulation and roof covering, the deck shall be inspected for tears, dents or other damage that may prevent the deck from acting as a structural roof base.
 - 1. The need for repair of the damaged deck shall be determined by the Structural Engineer of Record.
- B. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- C. Welds: Repair all portions of the steel roof deck coating damaged due to weld heat with compatible paint type or zinc rich compound. Repair all burn through marks in accordance with SDI Deck Damage and Penetrations.
- D. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
- E. Mechanical Fasteners: Replace or supplement under-driven and over driven fasteners with adjacent, properly installed fasteners.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Interior non-load-bearing wall framing.
4. Ceiling joist framing.
5. Soffit framing.
6. Shear wall framing
7. Diagonal Strap Bracing

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 REFERENCES

A. American Iron and Steel Institute (AISI):

1. AISI S100-12 North American Specifications for the Design of Cold Formed Steel Structural Members.
2. AISI S200-12 North American Standard for Cold-Formed Steel Framing - General Provisions.
3. AISI S201 North American Standard for Cold-Formed Steel Framing - Product Data.
4. AISI S202-15 "Code of Standard Practice". COSP-2015
5. AISI S211-07/S1-12 (2012) North American Standard for Cold-Formed Steel Framing - Wall Stud Design.
6. AISI S212-07 (2012) North American Standard for Cold-Formed Steel Framing – Header Design.
7. AISI S213-07/S1-09 (2012) North American Standard for Cold-Formed Steel Framing - Lateral Design.

- B. American Welding Society (AWS):
 - 1. AWS D.1.3 Structural Welding Code - Sheet Steel.
- C. International Code Council
 - 1. AC118 Acceptance Criteria for Self-Tapping Screw Fasteners
 - 2. AC261 Connectors Used with Cold-formed Steel Structural Members

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Interior non-load-bearing wall framing.
 - 3. Z-channel furring for attaching siding.
 - 4. Vertical deflection clips.
 - 5. Single deflection track.
 - 6. Double deflection track.
 - 7. Ceiling joist framing.
 - 8. Soffit framing.
 - 9. Post-installed anchors.
 - 10. Power-actuated anchors.
 - 11. Sill sealer gasket/termite barrier.
- B. Sustainable Design Submittals:
 - 1. Third-Party Certifications: For each product.
 - 2. Third-Party Certified Life Cycle Assessment: For each product.
- C. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - a. Layout and coordinate all bracing locations.
 - 3. Indicate connection details with screw types and locations, weld lengths and locations, fastening devices, and other fastener requirements.
- D. Delegated Design Submittal: For cold-formed steel framing.
 - 1. Structural calculations prepared by manufacturer for approval. Submittal shall be sealed by a professional engineer registered in the State of Ohio.
 - 2. Description of design criteria.

3. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application.
4. Selection of framing components, accessories and welded connection requirements.
5. Verification of attachments to structure and adjacent framing components.
6. Refer to Architectural Sections for additional miscellaneous cold form steel that requires Delegated Design. This includes, but is not limited to, the following:
 - a. Large soffit framing and supports
 - b. Long span interior non-load bearing wall headers
 - c. Interior non-load bearing walls
 - d. Z-channel furring on exterior walls
 - e. Architectural ceiling "cloud" framing and their attachments to the Primary Structural System.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Research Reports:
 1. For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
 2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 COLD-FORMED METAL FRAMING

- 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. Clark Dietrich
 2. Marino\WARE
 3. Simpson Strong-Tie
 4. Steel Network, Inc. (The)
- B. Provide cold-formed steel framing and connectors by a manufacturer that is a current member of one of the following steel framing member organizations:
 1. Certified Steel Stud Association (CSSA) www.certifiedsteelstud.com
 2. Steel Framing Industry Association (SFIA) www.steel framing association.org
 3. Steel Stud Manufacturers Association (SSMA) www.ssma.com
- C. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.
- D. Single Source Responsibility: Provide components and materials specified in this section from a single manufacturer where proprietary systems are used.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design

loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings and Wind Loads per Delegated Designer.
 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Load-Bearing Wall Framing: Horizontal Live Load deflection of $1/360$ of the wall height. $1/600$ at wall with brick veneer.
 - b. Interior Load-Bearing Wall Framing: Horizontal Live Load deflection of $1/360$ of the wall height under a horizontal load of 5 lbf/sq. ft.
 - c. Exterior Non-Load-Bearing Framing: Horizontal Live Load deflection of $1/360$ of the wall height. $1/600$ at wall with brick veneer.
 - d. Interior Non-Load-Bearing Framing: Horizontal Live Load deflection of $1/360$ of the wall height under a horizontal load of 5 lbf/sq. ft.
 - e. Roof Rafter Framing: Vertical Live Load deflection of $1/360$ of the horizontally projected span for live loads.
 - f. Ceiling Joist Framing: Vertical Live Load deflection of $1/360$ of the span for live loads and $1/240$ for total loads of the span.
 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 inch.
 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Design Standards: Design according to AISI's S100 "North American Specification for the Design of Cold-Formed Steel Structural Members".
1. AISI S200 "North American Standard for Cold-Formed Steel Framing – General Provisions".
 2. AISI S201 "North American Standard for Cold-Formed Steel Framing – Product Standard".
 3. AISI S211 "North American Standard for Cold-Formed Steel Framing – Wall Stud Design".
 4. AISI S212 "North American Standard for Cold-Formed Steel Framing – Header Design".
 5. AISI S213 "North American Standard for Cold-Formed Steel Framing – Lateral Design".
 6. AISI "Code of Standard Practice for Cold-Formed Steel Structural Framing".

- D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Framing Members, General: Comply with AISI S200 and ASTM C955, Section 8 for conditions indicated.
- B. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade:
 - a. ST33H for thicknesses less than 54 mils/0.0538 inch (16 Ga.).
 - b. ST50H for thicknesses greater than or equal to 54 mils/0.0538 inch (16 Ga.).
 - 2. Coating:
 - a. G90 or equivalent for studs with a brick veneer.
 - b. G60, A60, AZ50, or GF30 for all other studs, unless noted otherwise.
- C. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G60.

2.4 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0538 inch.
 - 2. Minimum Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0677 inch.
 - 2. Minimum Flange Width: 1-1/4 inches.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Flange Width: As required by design.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0538 inch.
 2. Minimum Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0677 inch.
 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips, Exterior: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich
 - b. Marino\WARE
 - c. Simpson Strong-Tie
 - d. Steel Network, Inc. (The)
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 1. Minimum Base-Metal Thickness: Per Cold Form Metal Framing Delegated Designer.
 2. Flange Width: Per Cold Form Metal Framing Delegated Designer.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 1. Outer Track: Per Cold Form Metal Framing Delegated Designer.
 2. Inner Track: Per Cold Form Metal Framing Delegated Designer.

2.6 EXTERIOR Z-CHANNEL FURRING

- A. Z-channels: Manufacturer's standard Z-shaped steel furring channels, of depths indicated

on the Drawings. Steel gage to be determined by the CFMF Delegated Designer.

1. Minimum Base Metal Thickness: 0.0329 inch.

2.7 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Minimum Flange Width: 1-3/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Minimum Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips, Interior: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich
 - b. Marino\WARE
 - c. Simpson Strong-Tie
 - d. Steel Network, Inc. (The)

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Size per Cold Form Metal Framing Delegated Designer.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Size per Cold Form Metal Framing Delegated Designer.

2.8 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Minimum Flange Width: 1-5/8 inches, minimum.

2.9 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-5/8 inches, minimum.

2.10 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.11 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

- B. Anchor Bolts: ASTM F1554, Grade 55, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
 2. Type: Per Cold Form Metal Framing Delegated Designer.
 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
 - a. In no case shall Phillips Bugle Head (PBH) or Phillips Wafer Head (PWH) screw head styles be used in metal-to-metal connections.
 - b. Use Phillips Flat Truss Head (PFTH) at locations where attached finishes may require a flush surface.
 2. Fasteners with breakaway wings are required when fastening through wood over 1/2 inch thick.
 3. Manufacturer's load values shall be based upon calculations done in accordance with Section E4 of AISI's S100 "North American Specification for the Design of Cold-Formed Steel Structural Members" (NASPEC) 2007 Edition.
 4. Self Drilling Screws (SDS) shall refer to the following minimum sizes, unless noted otherwise:
 - a. No.10 - #10-16 HWH screws; Diameter = 0.19 inch
 - b. No.10 - #10-12 PFTH screws; Diameter = 0.19 inch
 - c. No.12 - #12-14 HWH screws; Diameter = 0.216 inch
 - d. 1/4 inch – 1/4-14 HWH screws; Diameter = 0.24 inch
 5. Coating: Manufacturer's standard zinc coating complying with ASTM F1941-10 Standard Specification for Electrodeposited Coatings on Threaded Fasteners.
 6. Acceptable Self Drilling Screw Manufacturers:
 - a. Buildex TEK HWH (Fastener Head marked with "BX") – ICC-ES ESR-1976
 - b. Hilti HWH (Fastener Head marked with "H") – ICC-ES ESR-2196
 - c. Simpson Strong-Tie (Fastener Head marked with "≠") – ICC-ES ESR-3006
- E. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, 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 AC70.
1. HILTI, Inc.
 - a. X-U Universal Knurled Shank Fasteners, Diameter = 0.157 inches
 - b. DS Heavy Duty Fastener, Diameter = 0.177 inches
 - c. Minimum embedment length in concrete = 1 1/2 inches
 - d. Calibrate for required steel thickness when attaching to structural steel.

2. Simpson Strong Tie PDPT powder actuated pins
 - a. 0.300 inch head and 0.145 inch shank diameter
- F. Simpson SCB, SCW, and SSB connectors shall be installed with the #14 shouldered screws that are provided with the connectors.
- G. Holdowns
 1. Simpson Strong Tie – Size as indicated on shop drawings per Cold Form Metal Framing Delegated Designer
- H. Welding Electrodes: Comply with AWS standards.

2.12 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B or SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil nominal thickness, self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following or equal product:
 - a. Polyguard Products, Inc.
 2. Physical Properties:
 - a. Peel Adhesion: 17.0 lb/in of width when tested in accordance with ASTM D412.
 - b. Low-Temperature Flexibility: Pass at minus 25 deg F when tested in accordance with ASTM D146/D146M.
 - c. Water Vapor Permeance: 0.05 perm maximum when tested in accordance with ASTM E96/E96M, Method B.
 - d. Resistance to Termite Penetration: Comply with ICC-ES AC380.

2.13 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. No notching or coping of studs is allowed.
- K. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
- L. Construct all bearing walls, including strap bracing, prior to installing any roof framing.

3.4 INSTALLATION OF LOAD-BEARING WALL FRAMING

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: As shown on Shop Drawings.
- B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track.
 - 1. Fasten both flanges of studs to top and bottom tracks.
 - 2. Space studs as follows:
 - a. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs

cannot be aligned, continuously reinforce track to transfer loads.

- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
- G. Install jack studs or cripples below window sills, above window and door heads, at freestanding stair rails and elsewhere to furnish support. Securely attach to supporting members.
- H. Splices in axially loaded studs shall not be permitted.
- I. Construct corners using a minimum of 3 studs. Use double studs, one of which is full length unless indicated otherwise, at wall openings, doors, and window jambs.
- J. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
 - 2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- K. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- L. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- M. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to

reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

- N. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF EXTERIOR NON-LOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to bypassing infill studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip

angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- H. Z-Shaped Furring Members

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced as indicated on the Drawings.
2. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

3.7 FASTENERS

- A. Corded or cordless screwdriver tools with adjustable torque clutch and properly adjusted depth gauge are required.
 1. Do not exceed the manufacturer's recommended RPM for each type of fastener.
 2. Overdriving may cause connection failures or fastener failures that possibly compromise the integrity of the connection.
- B. Contractor shall be responsible for selecting the proper fastener drill flute and point length to properly connect the total thickness of the materials being joined per the Manufacturer's Published Installation Instructions.
- C. Where multiple fasteners are used, screws shall have a center-to-center spacing of at least 3 times the nominal diameter (d)
- D. Screws shall have a center-of-screw to edge-of-steel dimension of at least 1.5 times the nominal diameter (d) of the screw.
- E. The screw must penetrate through the supporting steel with a minimum of three threads protruding past the back side of the supporting steel.

3.8 INSTALLATION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.9 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
 - 1. Visually inspect 100 percent of welds for specified length, size, and continuity per AWS D1.3 for metal less than 1/8 inch thickness for Work designed as a structural element.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Manufacturer Services:
 - 1. Manufacturer's Field Services: Provide manufacturer's field services consisting of product use recommendations and periodic site visits for product installation inspection in accordance with manufacturer's instructions.
 - 2. Schedule site visits to review work at stages listed:
 - a. After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.
 - b. Twice during progress of work at 25% and 60% completion.
 - c. Upon completion of work, after cleaning is performed.
 - 3. Obtain reports within three days of review and submit immediately to Architect.
- E. Structural Observations:
 - 1. Structural Engineer to observe construction prior to installation of wall coverings.
 - 2. Contact Shell and Meyer Associates, Inc. at least two weeks prior to arrange date and time for field observation.
- F. Remove and replace work where test results indicate that it does not comply with specified requirements.
- G. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

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SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal ladders (Elevator Pit).
2. Metal downspout boots.
3. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Requirements:

1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Section 051200 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, loose lintels, and other steel items attached to the structural-steel framing.

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.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Shop primers.
2. Manufactured metal ladders.
3. Metal downspout boots.

- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - 1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
 - 2. Elevator machine beams, hoist beams, and divider beams.
 - 3. Steel shapes for supporting elevator door sills.
 - 4. Metal ladders.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates:
 - 1. Welding certificates.
 - 2. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials

without seam marks, roller marks, rolled trade names, or blemishes.

- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.3 FASTENERS

- A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- B. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- C. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- D. Post-Installed Anchors: Torque-controlled expansion anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
- E. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

- 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. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 METAL LADDERS

- A. General:
 - 1. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
 - 1. Space siderails 16 inches apart unless otherwise indicated.
 - 2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
 - 3. Rungs: 3/4-inch- diameter, steel bars.
 - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 - 6. Nonslip Surfaces for Steel Ladders: Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
 - 7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
 - 8. Prime ladders, including brackets and fasteners, with zinc-rich primer.

2.8 METAL DOWNSPOUT BOOTS

- A. Manufacturers: Subject to compliance with requirements:

1. J.R. Hoe & Sons Inc.
2. Neenah Foundry Company

- B. Source Limitations: Obtain downspout boots from single source from single manufacturer.
- C. Provide downspout boots made from cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.

1. Outlet: Vertical, to discharge into pipe.

- D. Prime cast-iron downspout boots with zinc-rich primer.

2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize bearing and leveling plates.
- C. Prime plates with zinc-rich primer.

2.10 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.11 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
 - 4. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners

for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.

3.3 INSTALLATION OF METAL LADDERS

- A. Secure ladders to adjacent construction with the clip angles attached to the stringer.
- B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.4 INSTALLATION OF METAL DOWNSPOUT BOOTS

- A. Anchor metal downspout boots to concrete or masonry construction to comply with manufacturer's written instructions.
- B. Secure downspouts terminations to downspouts and substrate per manufacturer's instructions.

3.5 INSTALLATION OF LOOSE BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no

voids remain.

3.6 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

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SECTION 055113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings and guards attached to metal stairs.
3. Steel tube handrails attached to walls adjacent 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.
- B. Coordinate installation of anchorages for metal stairs, railings, and guards.
 1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
- D. Schedule installation of railings and guards so wall attachments are made only to completed walls.
 1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.3 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.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

- B. Delegated Design Submittal: For stairs, railings and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 - 1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 - 2. Protect steel members and packaged materials from corrosion and deterioration.
 - 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
 - a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, railings and guards,, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the

following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to $L/360$ or $1/4$ inch, whichever is less.

C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed).
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.
 1. Select fasteners for type, grade, and class required.
- B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of

type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

- C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized, stairs indicated to be shop primed with zinc-rich primer.
- E. Post-Installed Anchors: [Torque-controlled expansion anchors] [or] [chemical anchors] capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
 - 3. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi and maximum aggregate size of 1/2 inch unless otherwise indicated.
 - 4. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
 - 5. Plain Steel Welded-Wire Reinforcement: ASTM A1064/A10645M, steel, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated on Drawings.
 - 6. 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.

2.4 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings and guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.

- B. Assemble stairs, railings, and guards in shop to greatest extent possible.
 - 1. Disassemble units only as necessary for shipping and handling limitations.
 - 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 3 - Partially dressed weld with spatter removed.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 - 2. Locate joints where least conspicuous.
 - 3. Fabricate joints that will be exposed to weather in a manner to exclude water.
 - 4. Provide weep holes where water may accumulate internally.

2.5 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Stringers: Fabricate of steel channels.
 - 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. Platforms: Construct of steel channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.
 - a. Provide closures for exposed ends of channel and rectangular tube framing.
 - b. Finish: Shop primed.
 3. Weld stringers to headers; weld framing members to stringers and headers.
 4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.
 1. Steel Sheet, Uncoated: Cold, Hot-rolled steel sheet unless otherwise indicated.
 2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 3. Shape metal pans to include nosing integral with riser.
 4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.6 FABRICATION OF STAIR RAILINGS AND GUARDS

- A. 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: 1-1/2-inch- square top and bottom rails and 1-1/2-inch- square posts.
 2. Picket Infill: 3/4-inch-, round pickets spaced to prohibit the passage of a 4-inch diameter sphere.
- B. Welded Connections: Fabricate railings and guards with welded connections.
 1. Cope components at connections to provide close fit, or use fittings designed for this purpose.
 2. Weld all around at connections, including at fittings.
 3. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 4. Obtain fusion without undercut or overlap.
 5. Remove flux immediately.
 6. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint, some undercutting and pinholes are okay as

shown in NAAMM AMP 521.

- C. Form changes in direction of railings and guards as follows:
 - 1. By flush bends.
- D. 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.
- E. Close exposed ends of railing and guard members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
 - 1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- G. Connect posts to stair framing by direct welding unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
 - 1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 2. For galvanized railings and guards, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 - 3. For nongalvanized railings and guards, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

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 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
 - 1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. 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.
- E. 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.

3.3 INSTALLATION OF RAILINGS AND GUARDS

- A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
 - 1. Space posts at spacing indicated or, if not indicated, as required by design loads.

2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
4. Secure posts, rail ends, and guard ends to building construction as follows:
 - a. Anchor posts to steel by welding, or, bolting to steel supporting members.
 - b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

B. Attach handrails to wall with wall brackets.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
2. Secure wall brackets to building construction as required to comply with performance requirements.
 - a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - b. For hollow masonry anchorage, use toggle bolts.

3.4 REPAIR

A. Touchup Painting:

1. 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.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055113

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SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Fire-retardant-treated lumber.
4. Dimension lumber framing.
5. Miscellaneous lumber.
6. Plywood backing panels.
7. I-joists. (Specified on the structural drawings.)

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.
2. Section 061753 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.
3. Section 062013 "Exterior Finish Carpentry" for exterior wood trim and soffits.
4. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. Lumber grading agencies, and abbreviations used to reference them, include the following:
 1. SPIB: The Southern Pine Inspection Bureau.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

2. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 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.

1.5 DELIVERY, STORAGE, AND HANDLING

- ##### A.
- Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

- ##### 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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
3. Dress lumber, S4S, unless otherwise indicated.

- ##### B. Maximum Moisture Content:

1. Boards: 15 percent.
2. Dimension Lumber: 15 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWWPA U1, use categories as follows:

1. UC2: Interior construction not in contact with ground but may be subject to moisture. As indicated on the Drawings or noted below.
 - a. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - b. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
2. UC3B (All Other Commodity Specifications): Uncoated products excluding sawn products in exterior construction not in contact with ground, exposed to all weather cycles including prolonged wetting. As indicated on the Drawings or noted below.
 - a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
3. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
4. After treatment, redry dimension lumber to 19 percent maximum moisture content.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior

masonry or concrete walls.

4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED LUMBER

- A. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 1. Treatment is not to promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.
- E. Application: Treat items indicated on Drawings, and the following:
 1. Framing for raised platforms.
 2. Concealed blocking.
 3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 4. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions by Grade: Construction or No. 2 grade.

1. Application: Interior partitions not indicated as load bearing.
2. Species:
 - a. Southern pine or mixed southern pine; SPIB.

B. Load-Bearing Partitions by Grade: No. 2 grade.

1. Application: Exterior walls.
2. Species:
 - a. Southern pine; SPIB.

C. Joists, Rafters, and Other Framing by Grade: No. 2 grade.

1. Species:
 - a. Southern pine; SPIB.

2.5 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Cants.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:

1. Mixed southern pine or southern pine; SPIB.

C. Concealed Boards: 19 percent maximum moisture content and the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 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 nominal thickness.

2.7 FASTENERS

- A. General: Fasteners are to be of size and type indicated and 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 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 with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.8 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. MiTek Industries, Inc.
 - 2. Tamlyn
- B. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
 - 1. Width: 1-1/4 inches.
 - 2. Thickness: 0.062 inch.
 - 3. Length: 24 inches.
- C. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.
- D. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.
- E. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.
 - 1. Bolt Diameter: 3/4 inch.
 - 2. Width: 3-3/16 inches.
 - 3. Body Thickness: 0.138 inch.
 - 4. Base Reinforcement Thickness: 0.239 inch.

F. Wall Bracing:

1. T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.
2. Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

G. Materials: Unless otherwise indicated, fabricate from the following materials:

1. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
 - a. Use for interior locations unless otherwise indicated.

2.9 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets:

1. Closed-cell neoprene foam, 1/4 inch 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. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- F. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- G. Do not splice structural members between supports unless otherwise indicated.

- H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- J. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- K. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- L. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- M. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
- N. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.
- O. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for attaching other work. Form to shapes

indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

- B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

3.3 INSTALLATION OF WALL AND PARTITION FRAMING

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.
 - 1. For exterior walls, provide 2-by-6-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
 - 2. For interior partitions and walls, provide 2-by-4-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
 - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
 - 2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated or, if not indicated, according to Table R502.5(1) or Table R502.5(2), as applicable, in ICC's International Residential Code for One- and Two-Family Dwellings.
- D. Provide diagonal bracing in exterior walls, at both walls of each external corner, at 45-degree angle, full-story height unless otherwise indicated. Use metal wall bracing, let into studs in saw kerf.

3.4 INSTALLATION OF CEILING JOIST AND RAFTER FRAMING

- A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
- B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
- C. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.5 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.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing (for both asphalt shingle and fully adhered EPDM roofing).
3. Subflooring and Underlayment. (Above Room C121 as indicated on the Drawings.)
4. Sheathing joint-and-penetration treatment materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. For air-barrier and water-resistant glass-mat gypsum sheathing, include

manufacturer's technical data and tested physical and performance properties of products.

- B. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.
 - 1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
 - 2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 3. Include details of interfaces with other materials that form part of air barrier.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.
- B. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated plywood.
 - 2. Fire-retardant-treated plywood.
 - 3. Air-barrier and water-resistant glass-mat gypsum sheathing.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified

testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

B. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing Performance: Air-barrier and water-resistant glass-mat gypsum sheathing assembly, and seals with adjacent construction, are to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies are to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.2 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings.

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 in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and

with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 4. Design Value Adjustment Factors: Treated lumber plywood is to be tested in accordance with ASTM D5516 and design value adjustment factors are to be calculated in accordance with ASTM D6305. Span ratings after treatment are to 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 are to be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings

2.5 WALL SHEATHING

- A. Oriented-Strand-Board or Plywood Sheathing: DOC PS 2, Exposure 1 sheathing.
1. Span Rating: Not less than 32/16.
 2. Nominal Thickness: Not less than 1/2 inch.
 3. Locations: At all wood frame exterior walls.
- B. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M, Type X, coated fiberglass mat gypsum sheathing with integral weather-resistant barrier and air barrier complying with ASTM E2178. (Coordinate product with UL Ratings for limited exterior rated wall locations indicated on the drawings.)
1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Gypsum, LLC., DensElement Barrier System or comparable product by one of the following:
 - a. USG Corporation
 2. Thickness: 5/8 inch thick.
 3. Size: 48 by 96 inches for vertical installation.

4. Edges: Square.
5. Flashing and Transitions Strips: As acceptable to sheathing manufacturer.
6. Air Permeance: Maximum 0.001 cfm/ft² pressure difference when tested in accordance with ASTM E2178.
7. Vapor Permeance: Minimum 20 perms when tested in accordance with ASTM E96/E96M, Desiccant Method, Procedure A.
8. Sheathing Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. when tested in accordance with ASTM E2357.
9. Fire Propagation Characteristics: Complies with NFPA 285 testing as part of an approved assembly.
10. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by sheathing manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
11. Locations: At all cold-formed metal framed exterior walls.

2.6 ROOF SHEATHING

- A. Plywood Sheathing: DOC PS 1, Exposure 1 sheathing.
1. Span Rating: Not less than 32/16.
 2. Nominal Thickness: Not less than 15/32 inch.
 3. At fully adhered EPDM roof area, coordinate plywood substrate (and fasteners), along with installation tolerances, with roofing manufacturer requirements.

2.7 SUBFLOORING AND UNDERLAYMENT

- A. Plywood Combination Subfloor-Underlayment: Tongue and Groove, APA Rated Sheathing, DOC PS-1: DOC PS 1, single-floor panels.
1. Span Rating: Not less than 32.
 2. Nominal Thickness: Not less than 3/4 inch.
 3. Edge Detail: Tongue and groove.
 4. Surface Finish: Fully sanded face.

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, wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.
- E. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 - 1. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.
- F. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours in accordance with ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

2.9 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. 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 wide, 10 by 10 or 10 by 20 threads/inch, 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.

2.10 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 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 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall, sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF WOOD STRUCTURAL PANEL

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Subflooring:
 - a. Glue and nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.
 - 2. Wall and Roof Sheathing:
 - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.

3.3 INSTALLATION OF GYPSUM SHEATHING

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to wood framing with nails, or, screws.
 - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

- C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

- D. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel 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.

- E. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing:
 - 1. Install accessory materials according to sheathing manufacturer's written instructions and details to form a seal with adjacent construction, to seal fasteners, and ensure continuity of air and water barrier.
 - 2. Connect and seal sheathing material continuously to air barriers specified under other Sections as well as to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
 - 3. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
 - 4. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip, so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
 - a. Transition Strip: Roll firmly to enhance adhesion.

- b. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
5. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of sheathing material with foam sealant.
6. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
7. Seal top of through-wall flashings to sheathing with an additional 6-inch- wide, transition strip.
8. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
9. Repair punctures, voids, and deficient lapped seams in strips and transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 FIELD QUALITY CONTROL

- A. Inspections: Air-barrier and water-resistant glass-mat gypsum sheathing, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 3. Termination mastic has been applied on cut edges.
 4. Strips and transition strips have been firmly adhered to substrate.
 5. Compatible materials have been used.
 6. Transitions at changes in direction and structural support at gaps have been provided.
 7. Connections between assemblies (sheathing and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 8. All penetrations have been sealed.

END OF SECTION 061600

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SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

When the information in this Specification Section conflicts with information on the Structural Construction Drawings, the Structural Construction Drawings shall prevail.

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood roof trusses.
 - 2. Wood girder trusses.
 - 3. Wood truss bracing.
 - 4. Metal truss accessories.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for roof sheathing.
- C. Materials used in temporary and permanent restraint and bracing shall be furnished by the Contractor.

1.2 DEFINITIONS

- A. Contractor: Owner of a Building, or the person who contracts with the Owner, who constructs the Building in accordance with the Construction Documents and the Truss Submittal Package. The term "Contractor" shall include those subcontractors who have a direct contract with the Contractor to construct all or a portion of the construction.
- B. Cover/Truss Index Sheet: Sheet that is signed and sealed by the Truss Design Engineer and shall contain the following information: (1) identification of the Building, including Building name and address; (2) specified Building Code; (3) computer program used; (4) roof dead and live loads; (5) wind load criteria from a specifically defined code; (6) a listing of the individual identification numbers and dates of each Truss Design Drawing referenced by the Cover /Truss Index Sheet and (7) name, address, date of drawing and license number of Truss Design Engineer.
- C. Framing Structural System: Completed combination of Structural Elements, Trusses, connections and other systems, which serve to support the Building's self-weight and the specified loads.
- D. Metal-Plate-Connected Wood Trusses (Truss): Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.
- E. Registered Design Professional (RDP): Architect or Structural Engineer, who is licensed to practice their respective design profession and who contracts with the Owner for the design of the Framing Structural System and who is responsible for the preparation of the Construction Documents.
- F. Truss Component Manufacturer: The maker of the components that will be assembled into trusses by the Truss Fabricator. See MANUFACTURERS for acceptable Truss Component Manufacturers.

- G. Truss Design Drawings (TDD): Written, graphic and pictorial depiction of an individual Truss that includes the information required in TPI Sections 2.3.5.5 and 2.4.5.4
- H. Truss Design Engineer: Person who is licensed to practice engineering in the State of Ohio and who supervises the preparation of the Truss Design Drawings
- I. Truss Designer: Person responsible for the preparation of the Truss Design Drawings.
- J. Truss Fabricator: The manufacturer who assembles the Truss Component Manufacturer's components into completed trusses.
- K. Truss Installer: The Contractor, or subcontractor, responsible for the safe lifting/hoisting and installation of the Metal-Plate-Connected Wood Trusses, including the installation of all temporary and permanent restraints and bracing.
- L. Truss Placement Diagram (TPD): Illustration identifying the assumed location of each Truss.
- M. Truss Submittal Package: Package consisting of each individual Truss Design Drawing, and the Truss Placement Diagram, the Cover/Truss Index Sheet, Lateral Restraint and Diagonal Bracing details designed in accordance with generally accepted engineering practice, applicable BCSI defined Lateral Restraint and Diagonal Bracing details, and any other structural details germane to the Trusses.

1.3 PRE-INSTALLATION MEETINGS

- A. Trusses with a span greater than 60'-0" require a pre-installation meeting with the Contractor, Truss Installer, and Shell and Meyer.
 - 1. Meeting shall be held at the job site trailer or other mutually agreed upon location.
 - 2. Contact Shell and Meyer at least two (2) weeks prior to truss installation to arrange meeting date.
 - 3. An approved Truss Submittal Package shall be completed prior to arrangement of pre-installation meeting.
 - 4. The Truss Installer shall be familiar with the requirements of the latest edition of BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses" prior to the meeting.

1.4 ACTION SUBMITTALS

- A. Shop Drawings (Truss Submittal Package): Show fabrication and installation details for trusses as outlined below. Truss manufacturer shall not modify the truss layout shown on the Structural Construction Documents without first consulting with and getting approval from the RDP. Any modification requests shall be made during the bidding period or may be subject to additional engineering fees if submitted during the shop drawing review process.
 - 1. Truss Design Drawings:
 - a. Indicate Building Code used for design, unless specified on Cover/Truss Index Sheet
 - b. Show Design loads as applicable, including Top Chord live load (for roof Trusses, this shall be the controlling case of live load or snow load); Top Chord dead load; Bottom Chord live load; Bottom Chord dead load; Additional loads and locations; Environmental Load Design Criteria (wind

- speed, snow, seismic, and all applicable factors as required to calculate the Truss loads); and other lateral loads, including drag strut loads.
- c. Refer to Architectural elevations for mean roof height elevations for use in Wind Load calculations.
 - d. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 - e. Indicate connection requirements for all truss to truss connections, truss to truss girders, truss ply to ply, and field splices.
 - f. Indicate sizes, stress grades, and species of lumber.
 - g. Indicate locations, sizes, and materials for Permanent Individual Truss Member Restraints (PITMR) required to prevent buckling of individual truss members due to design loads per TPI 1 Sections 2.3.3 and 2.4.3.
 - 1) Truss designer shall provide T-Reinforcement, or other acceptable alternative detail, when continuous lateral restraints for a truss web cannot be attached to adjacent trusses due to dissimilar web configurations.
 - h. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - i. Indicate reactive forces, their points of occurrence and direction;
 - j. Indicate calculated deflection ratio and maximum vertical deflection (and horizontal for scissors trusses) for live and total load;
 - k. Show bearing details including required bearing widths.
 - 1) If inadequate bearing is noted on the Truss Design Drawing design output and the required bearing width is not greater than 3/4" plus the provided bearing width, then the Truss Designer shall provide one of the following:
 - a) Truss bearing blocks attached to truss per Truss Designer's specifications.
 - b) Simpson Truss Bearing Enhancers 'TBE' – one on each side of truss at the location requiring additional bearing.
 - l. Include all details referenced in the Truss Design Drawings.
 2. Truss Placement Diagram: Truss Manufacturer shall furnish a Truss Placement Diagram which shall provide at a minimum the location assumed for each Truss based on the Truss Manufacturer's interpretation of the Construction Documents.
 - a. Dimensions shall be indicated to outside face of wood framing.
 - b. Where applicable, actual dimensions of Concrete Masonry Units shall be used (not nominal, i.e. 7-5/8" not 8").
 3. Truss Bracing Plan: Truss Designer shall submit a truss bracing plan for use by the Truss Installer during placement of the trusses. This plan shall indicate top and bottom chord temporary lateral restraints and diagonal braces.
- B. Truss Manufacturer shall submit the Truss Submittal Package to the Registered Design Professional for review and approval prior to the manufacturing of trusses.
- C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the Truss Design Engineer responsible for their preparation. The qualified professional engineer shall be licensed in the State of Ohio.

- D. Truss Submittals and any supplementary information provided by the Truss Manufacturer shall be provided by the Contractor to the individual or organization responsible for the installation of the Trusses.

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 that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
 - 1. Trusses shall be handled during manufacturing, delivery and by the Contractor at the job site so as not to be subjected to excessive bending.
 - 2. Trusses shall be unloaded on smooth ground to avoid lateral strain.
 - 3. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 4. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 5. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer registered in the State of Ohio, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated on Structural Drawings and noted below.
 - a. Reference Roof Framing Plans for Snow Drift Loads and Drag Strut Loads (if applicable)
 - b. Add additional 5 PSF Dead Load on trusses below built-up 2x framing or valley set areas.
2. Maximum Deflection Under Design Loads:
 - a. Roof Trusses:
 - 1) Vertical Live Load deflection of the lesser of 1/240 of span or 1 inch.
 - 2) Vertical Total Load deflection of 1/240 of span.
- C. Comply with applicable requirements and recommendations of the following publications. The Structural Engineer of Record shall not be responsible for delays in construction due to shop drawings being rejected for non-compliance with the following publications:
 1. ANSI/ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures"
 2. BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses." (Jointly produced by WTCA and TPI)
 3. ANSI/TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 4. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Provide dressed lumber, S4S.
 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Minimum Chord Size for Roof Trusses: 2 by 6 inches nominal for both top and bottom chords.
- C. Adjustment of values for duration of load or conditions of use shall be in accordance with National Design Specifications for Wood Construction (NDS).
- D. Minimum Specific Gravity for Top Chords: 0.50.
- E. Fire retardant treated lumber, if applicable, shall meet the specifications of the fire retardant chemical manufacturer, TPI 1, and the Truss design. The fire retardant treated lumber shall be re-dried after treatment in accordance with the American Wood-Preservers' Association (AWPA) Standard C20 Structural Lumber—Fire Retardant Treatment by Pressure Processes. Allowable values must be adjusted in accordance with NDS. Lumber treater shall supply certificate of compliance.

- F. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 1000 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

- A. Metal Connector Plates shall be manufactured by a Truss Plate Institute (TPI) member plate manufacturer and shall comply with TPI 1. Working stresses in steel are to be applied to Effectiveness Ratios for plates in accordance with the Standard.
- B. 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. Alpine Engineered Products, Inc.; an ITW company.
 - 2. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
 - 3. Truswal Systems Corporation; an ITW company.
- C. Source Limitations: Obtain metal connector plates from single manufacturer.
- D. General: Fabricate connector plates to comply with TPI 1.
- E. Hot-Dip Galvanized-Steel Sheet: ASTM A 653; 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 coating designation; and not less than 0.036 inch thick.
 - 1. Use for interior locations unless otherwise indicated.

2.4 FASTENERS

- A. General: 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.
- B. Nails: ASTM F 1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.
- C. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- D. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- E. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A 653; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for connections to wood-preserved-treated lumber and where indicated.

- F. Stainless-Steel Sheet: ASTM A 666, Type 304.
 - 1. Use for exterior exposed locations and where indicated.
- G. Truss Tie-Downs (Hurricane or Seismic Ties): As indicated on structural details.
- H. Drag Strut Connectors: Heavy gauge metal bent plate (0.179 inches or 0.239 inches., as specified) installed to transfer drag strut loads from the bearing end of a girder truss into a beam or shear wall running parallel to the girder truss. Right hand or left hand designations required when ordering.
- I. Roof Truss Clips (Deflection Clips): Angle clips for allowing vertical truss deflection at non-load-bearing walls, 2-1/2 inches wide by 0.050 inch thick with (2) 1-1/2" vertical slots. Clip is fastened to truss through slotted holes to allow for truss deflection.
- J. Roof Truss Spacer Restraint: U-shaped channels, 1-3/4 inches wide by 1 inch deep by 0.033 inch thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses. If used, spacers shall also be capable of providing restraint per BCSI.
- K. Truss Bearing Enhancers: 3-9/16 inches wide (2x4 wall installation) or 5-9/16 inches wide (2x6 wall installation) by 0.050 inch thick. Transfers load from a truss or girder truss to plates for bearing-limited conditions where a bearing block has not been provided in the Truss Design Drawings.
- L. Valley Truss Clip: 2-1/2 inches wide by 5-1/2 inches by 0.050 inch thick bent plate. Clip is installed to valley set truss and to framing members below. Clip is attached over the roof sheathing.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

2.7 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Trusses shall be fabricated in a properly equipped manufacturing facility of a permanent nature.
- D. Trusses shall be manufactured by experienced workmen, using jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1 Chapter 3 and in accordance with the information provided in the final approved Truss Design Drawings.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- E. 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 GENERAL TRUSS INSTALLATION

- A. Truss installation shall be done by a qualified and experienced contractor with a record of successfully erecting metal plate connected wood trusses of similar span. Truss erection by an inexperienced or unqualified contractor can result in serious truss collapse and/or serious injury and damage.
- B. Installation shall be consistent with good workmanship and good building practices and shall be the responsibility of the Truss Installer.
- C. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- D. Install wood trusses only after supporting construction is in place and is braced and secured.
- E. Install multi-ply studs directly under all girder truss bearing points. Provide equal number of studs as truss plies, unless noted otherwise.
- F. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated on the Truss Design Drawings.
- G. 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.
- H. Install and brace trusses according to the recommendations set forth in latest edition of BCSI and as indicated.
 - 1. The Contractor is responsible for obtaining and furnishing the materials necessary for installation and permanent restraint and bracing of the truss system.
- I. Install wood trusses within installation tolerances set forth in TPI 1 and BCSI-B1.
- J. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- K. Each Truss shall be held in correct alignment and location before specified permanent restraint and bracing is installed.
- L. Anchor trusses securely at all bearing points (including interior bearing supports); use metal truss tie-downs as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- M. 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.
- N. Trusses shall be anchored or restrained to prevent out-of-plane movement so as to keep all Truss members from simultaneously buckling together in the same direction. Such permanent Lateral Restraint shall be accomplished by including permanent diagonal bracing in the plane of the Lateral Restraints or other suitable means. (Reference BCSI-B3)
- O. Install bracing to comply with Section 06 1000 "Rough Carpentry."
 - 1. Install and fasten strongback bracing vertically against vertical webs of gable end roof trusses.
- P. Concentrated loads shall not be placed atop trusses until all specified bracing has been installed and decking is permanently nailed in place. Specifically, do not stack full bundles of decking or other heavy materials onto unsheathed trusses.
- Q. Continue roof sheathing below valley set truss bearing. Install 2x4 blocking at 24" o.c. between the top chords of the main trusses where valley sets do not bear on a minimum of three (3) trusses.

- R. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- S. Apparent damage to trusses, if any, shall be reported to Manufacturer prior to installation.

3.2 FIELD QUALITY CONTROL

- A. Special Inspections: For trusses spanning 60 feet or greater, Owner will engage a qualified special inspector to perform the special inspections indicated on the Contract Drawings

3.3 TRUSS REPAIRS

- A. Replace wood trusses that are damaged or do not meet requirements.
- B. If a Truss is damaged, altered or improperly installed:
 1. Temporarily brace or support the Truss to prevent further damage to Truss and danger to workers.
 2. Report damage, alterations or installation errors to the Truss Manufacturer immediately.
 3. Do not attempt to repair the Truss without a Repair Detail from the Truss Designer or Truss Manufacturer.
 4. Prior to the beginning of repair, lay the Truss flat on a solid, level surface. If the Truss is already installed, shore up the Truss to relieve any load.
 5. Repair the Truss by following the information provided in the Repair Detail exactly. Make sure to use the correct materials as specified. Seek professional guidance if anything is unclear.
 6. Keep the Repair Detail in case the Building Official, Owner, or Registered Design Professional requests it.
 7. If the Repair Detail is not for the specific field condition you are repairing, do not use it. Always follow the repair detail for your specific situation.
 8. If the designed repair cannot be accomplished, call the Truss Designer, Truss Manufacturer, or Registered Design Professional.
 9. Truss Repair Details shall be signed and sealed by the Truss Design Engineer responsible for truss design.
- C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

3.4 TRUSS PROTECTION

- A. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061753

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SECTION 062013 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior trim (Fascia's).
2. Plywood soffits.

B. Related Requirements:

1. Section 074646 "Fiber-Cement Siding" for paneled siding.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

1.3 INFORMATIONAL SUBMITTALS

A. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
2. For preservative-treated wood that is not marked with treatment-quality mark.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.

2. Provide for air circulation around stacks and under coverings.

1.5 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.
- B. Softwood Plywood: DOC PS 1.
- C. Hardboard: ANSI A135.4.

2.2 EXTERIOR TRIM

- A. Lumber Trim for Transparent Finish (Opaque Stain or Clear Finish):
 1. Species and Grade:
 - a. Western red cedar; NLGA, WCLIB, or WWPA Grade A.
 2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 3. Finger Jointing: Not allowed.
 4. Face Surface: Surfaced (smooth).

- B. Moldings for Transparent Finish (Opaque Stain or Clear Finish): MMPA WM 4, N-grade wood moldings, without finger jointing, made from kiln-dried stock to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."

- 1. Species: Western red cedar.

2.3 LUMBER SOFFITS

- A. Provide kiln-dried lumber siding complying with DOC PS 20.

- B. Species and Grade:

- 1. Western red cedar; NLGA, WCLIB, or WWPA Grade A, Clear NR.

- C. Pattern: Plain.

- D. Surface: Rough sawn.

- E. Thickness: 1/2 inch.

2.4 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.

- 1. For pressure-preservative-treated wood, provide hot-dip galvanized-steel fasteners.
 - 2. For applications not otherwise indicated, provide hot-dip galvanized-steel fasteners.

- B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.

- C. Continuous Aluminum Soffit Vents: Air Vent Inc. Model SV202, 2 3/4 inches wide and in lengths not less than 96 inches.

- 1. Net-Free Area: 9 sq. in./linear ft..
 - 2. Finish: Brown paint.

2.5 FABRICATION

- A. Back out or kerf backs of standing and running trim wider than 5 inches, except members with ends exposed in finished work.

- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
- B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut exterior finish carpentry to fit adjoining work.
 - 3. Refinish and seal cuts as recommended by manufacturer.
 - 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
 - 6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 INSTALLATION OF STANDING AND RUNNING TRIM

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.
 - 1. Use scarf joints for end-to-end joints.
 - 2. Stagger end joints in adjacent and related members.
- B. Fit exterior joints to exclude water.
 - 1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface

- contact throughout length of joint.
 - 2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- C. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.5 ADJUSTING

- A. Replace exterior finish carpentry that is damaged or does not comply with requirements.
 - 1. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean exterior finish carpentry on exposed and semiexposed surfaces.

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062013

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**SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS –
INTERIOR WOOD TRIM**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim for transparent finish.
2. Plastic-laminate-clad architectural cabinets and casework.
3. Adjustable wall mounted shelving.
4. Plastic-laminate countertops.
5. Cabinet hardware and accessories.
6. Tackboards.
7. Sliding pass thru windows and frame assemblies.
8. Miscellaneous materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

1.2 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

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. 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. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
5. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.
 - a. Provide one sample applied to core material with specified edge material applied to one edge.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer, and Installer.

1.6 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.7 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.

- B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 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 and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 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: 5 to 10 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, MD.
 - 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.
 - 5. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
 - 6. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from

untreated materials.

7. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
8. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
9. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
10. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
11. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in the same area of the building, unless otherwise indicated.
 1. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
- C. For rails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.
- D. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- E. Assemble casings in plant except where limitations or access to place of installation require field assembly.
- F. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

2.3 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 from AWI certification program indicating that woodwork and

installation complies with requirements of grades specified.

- B. Architectural Woodwork Standards Grade: Premium.
- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products as indicated on the Drawings.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade VGS.
 - 4. Edges: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
 - 5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- G. Materials for Semi-exposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
 - b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - 2. Drawer Sides and Backs: Thermally fused laminate panels with PVC or polyester edge banding.
 - 3. Drawer Bottoms: Thermally fused laminate panels.
- H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- I. Drawer Construction: Fabricate with exposed fronts fastened to sub front with mounting screws from interior of body.
 - 1. Join sub fronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners, glued dovetail joints.
- J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and

textures of exposed laminate surfaces complying with the following requirements:

1. Match Architect's sample or as indicated on the drawings.

2.4 ADJUSTABLE WALL MOUNTED SHELVING

- A. Grade: Custom.
- B. Shelf Material: 2/4-inch Thermally Fused Laminate (TFL) Panels with PVC or polyester edge banding.
- C. Supports:
 1. Brackets: Knape and Vogt 187LL with lock lever and 211 shelf rest or equal.
 2. Standards: Knape and Vogt 87 Heavy Duty or equal.

2.5 PLASTIC LAMINATE COUNTERTOPS

- A. Grade: Premium.
- B. High-Pressure Decorative Laminate Grade: HGS
- C. Colors, Patterns and Finishes: Provide materials and products that result in colors and textures or exposed laminate surfaces complying with the following requirements:
 1. As indicated on the Drawings.
- D. Grain Direction: Parallel to cabinet fronts or as indicated on the Drawings.
- E. Edge Treatment: Matching 1-1/4-inch PVC edge band.
- F. Core Material: Particleboard.
- G. Core Material at sinks: exterior grade plywood.
- H. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.6 CABINET HARDWARE AND ACCESSORIES

- A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."
 1. Manufacturers: Subject to compliance with requirements, :
 - a. Grass America

- b. Julius Blum & Co., Inc.
 - c. Knappe & Vogt Manufacturing Company
 - d. Best
 - e. Stanley
 - f. Doug Mockett & Company, Inc.
- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 170 degrees of opening, self-closing.
- C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.
- F. Shelf Rests: ANSI/BHMA A156.9, B04013; two-pin plastic with shelf hold-down clip.
- G. Drawer Slides: ANSI/BHMA A156.9.
- 1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount.
 - a. Type: Full overtravel extension.
 - b. Material: Zinc-plated ball bearing slides.
 - 2. Pencil drawers not more than 3 inches high and not more than 24 inches wide, provide 50 lb load capacity.
 - 3. General-purpose drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide 100 lb load capacity.
 - 4. File drawers more than 6 inches high or more than 24 inches wide, provide 200 lb load capacity.
 - 5. Lateral file drawers more than 6 inches high and more than 24 inches but not more than 30 inches wide, provide 200 lb load capacity.
 - 6. Computer keyboard tray, provide 100 lb load capacity.
- H. Door Locks: ANSI/BHMA A156.11, E07121. Provide 25, location to be determined.
- I. Drawer Locks: ANSI/BHMA A156.11, E07041. Provide 25, location to be determined.
- J. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- K. Grommets for Cable Passage: 1-3/4-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
- 1. Product: Doug Mockett & Company, Inc. "EDP Series"
 - 2. Color: Black.
 - 3. Quantity: 50 grommets to be located in field by Owner.
- L. Coat hook for coat racks: Peter Pepper model #2057XL. Refer to detail on the Drawings.

- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 - 1. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
- N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.7 TACKBOARDS

- A. Substrate: N.C.F.R Homasote by Homasote Company.
 - 1. Thickness: 1/2-inch.
 - 2. Fire Rating: Class A.
- B. Fabric Facing: Acoustical wall covering as indicated on the drawings.
- C. Edges: Wrap with fabric.

2.8 SLIDING PASS THRU WINDOW AND FRAME ASSEMBLIES

- A. Materials: Clear anodized aluminum frame and clear tempered glass. Refer to Division 8 Section 081000 "Glazing" for glass.
- B. Product: Framed opening with recessed bottom track, head and jambs to support sliding glass panels. Provide Knopt and Vogt Roll-Ezy Aluminum Track assembly or equal.
- C. Accessories: Cam-type locks.

2.9 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.10 FABRICATION

- A. Fabricate architectural cabinets and casework and countertops to dimensions, profiles, and details indicated.

- B. 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.
 - 1. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- 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 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 o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semi exposed surfaces.

END OF SECTION 064116

SECTION 066140 – SOLID SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Solid surface countertops.
- 2. Solid surface integral sinks.

- B. Related Requirements:

- 1. Section 064116 "Plastic-Laminate Clad Architectural Cabinets – Interior Wood Trim".

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

- 1. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in solid surfacing.

- C. Samples: For verification of each color.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface materials to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution of solid surface countertops.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install solid surface materials until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Solid-Surface Materials: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - 1. Manufacturers: Subject to compliance with requirements, provide products as indicated on the Drawings. Substitutions not permitted.
- B. FABRICATION
- C. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WT's "Architectural Woodwork Standards."
 - 1. Grade: Premium.

2.2 SOLID SURFACE COUNTERTOPS, BACKSPLASHES

- A. Materials:
 - 1. Grade: Premium.
 - 2. Solid-Surfacing-Material Thickness: 1/2-inch or as detailed on Drawings.
 - 3. Colors, Patterns and Finishes: Provide materials and products that results in color and textures of exposed solid surfaces complying with the following requirements as indicated on Drawings.
 - 4. Countertops: Beveled (unless noted otherwise on Drawings), 1/2-inch thick, solid surface material.
 - 5. Backsplash: Straight, slightly eased at corner, 1/2-inch thick, solid surface material.
 - 6. End Splash: Matching backsplash.

7. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
8. Install integral sink bowls in countertops in the shop.
9. Fabricate countertops without joints. If joints are required due to size restrictions, verify location on shop drawings.
10. Cutouts and Holes:
 - a. Prepare countertops in shop for field cutting openings for fixtures using template or pattern furnished by fixture manufacturer. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.3 SOLID SURFACE INTEGRAL SINKS

A. Materials:

1. Manufacturers: Subject to compliance with requirements, provide products as indicated on the Drawings. Substitutions not permitted without prior approval.
2. Size, Color, and Finish: Provide materials and products that results in color and textures of exposed solid surfaces complying with the following requirements as indicated on Drawings.

2.4 ACCESSORIES

A. Adhesive: As recommended by manufacturer.

B. Sealant: Comply with applicable requirements in Section 079200 "Joint Sealants."

1. Color: color match or verify with Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Prior to installation, clean area to remove dust, debris, and loose particles.
- B. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- C. Fasten sub-tops to cabinets by screwing through sub-tops into corner blocks of base cabinets. Shim as needed to align sub-tops in a level plane.
- D. Secure countertops to sub-tops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Pre-drill holes for screws as recommended by manufacturer.
- 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. Install components of shower base and surrounds plumb and level, scribe adjacent finishes, in accordance with approved shop drawings and recommended installation instructions.
- I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."
- J. Protect installed countertops with heavy covering during construction period to prevent staining or damage. Remove before final inspection.

END OF SECTION 066140

SECTION 071700 - BENTONITE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Geotextile/bentonite sheets.
2. Molded-sheet drainage panels.

B. Related Requirements:

1. Civil Engineering drawings and specification notes.

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 construction details, material descriptions, and installation instructions.

- B. Shop Drawings: Include installation details for waterproofing, penetrations, and interface with other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of waterproofing material.

- B. Field quality-control reports.

- C. Sample Warranty: For manufacturer's special warranty.

1.5 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturer's written instructions and warranty requirements.

1. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not

- apply bentonite waterproofing materials in areas with standing water.
2. Do not place bentonite clay products in panel or composite form on damp surfaces unless such practice is approved in writing by manufacturer.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agree(s) to repair or replace components of bentonite waterproofing system 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 GEOTEXTILE/BENTONITE SHEETS

- A. Geotextile/Bentonite Sheet: Minimum of 1.0 lb/sq. ft. of bentonite clay granules between two layers of polypropylene geotextile fabric, one woven and one nonwoven, needle punched and heat fused together.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Carlisle Coatings and Waterproofing Inc, CCW MiraCLAY or comparable product by one of the following:
 - a. CETCO is a subsidiary of Minerals Technologies Inc.
 - b. MAPEI Corporation
 2. Grab Tensile Strength: 95 lbf in accordance with ASTM D4632.
 3. Puncture Resistance: 100 lbf in accordance with ASTM D4833.

2.2 MOLDED-SHEET DRAINAGE PANELS

- A. Provide CCW 9800 for horizontal below slab applications, CCW 6200 on vertical surfaces and CCW QuickDRAIN at footers.

2.3 ACCESSORIES

- A. Granular Bentonite: Sodium bentonite clay containing a minimum of 90 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a No. 20 sieve.
- B. Bentonite Mastic: Bentonite compound of trowelable consistency, specifically formulated for application at joints and penetrations.

- C. Bentonite Tubes: Manufacturer's standard 2-inch- diameter, water-soluble tube containing approximately 1.5 lb/ft. of granular bentonite; hermetically sealed; designed specifically for placing on wall footings at line of joint with exterior base of wall.
- D. Cement Grout Patching Material: Grout mix compatible with substrate being patched and recommended in writing by waterproofing manufacturer.
- E. Sealants: As recommended in writing by waterproofing manufacturer. Comply with requirements specified in Section 079200 "Joint Sealants."
- F. Tapes: Waterproofing manufacturer's recommended waterproof tape for joints between sheets, membranes, or panels.
- G. Adhesive: Waterproofing manufacturer's water-based adhesive used to secure waterproofing to both vertical and horizontal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations and other conditions affecting performance of bentonite waterproofing.
- B. Examine bentonite materials before installation. Reject materials that have been prematurely exposed to moisture.
- C. Verify that substrate is complete and that work that will penetrate waterproofing is complete and rigidly installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions.
- B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.
- C. Horizontal Concrete Surfaces: Remove debris, standing water, oily substances, mud, and similar substances that could impair the bonding ability of concrete or the effectiveness of waterproofing. Fill voids, cracks greater than 1/8 inch, honeycomb areas, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.

- D. Excavation Support and Protection System: If water is seeping, use plastic protection sheets or other suitable means to prevent wetting the bentonite waterproofing. Fill minor gaps and spaces 1/8 inch wide or wider with wood, metal, concrete, or other appropriate filling material. Cover or fill large voids and crevices with cement mortar according to manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

- A. Prepare substrates, voids, cracks, and cavities; and install waterproofing and accessories according to manufacturer's written instructions.
 - 1. Before installing, verify the correct side of waterproofing that faces substrate surface.
 - 2. Apply granular bentonite around penetrations in horizontal surfaces and changes in plane according to manufacturer's details in preparation for bentonite tubes and mastic.
 - 3. Apply bentonite tubes, bentonite mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.
 - 4. Prime concrete substrates. Primer may be omitted on concrete surfaces that comply with manufacturer's written requirements for dryness, surface texture, and freedom from imperfections.
- B. Apply bentonite tubes continuously on footing against base of wall to be waterproofed.
- C. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts.
- D. Install protection course before backfilling or placing overburden when recommended in writing by waterproofing manufacturer.

3.4 INSTALLATION OF GEOTEXTILE/BENTONITE SHEETS

- A. Install a continuous layer of waterproofing sheets directly against surface to be waterproofed. Lap ends and edges a minimum of 4 inches on horizontal and vertical substrates unless otherwise indicated. Stagger end joints between sheets a minimum of 24 inches. Fasten seams by stapling to adjacent sheet or nailing to substrate.
- B. Below Structural Slabs-on-Grade: Place waterproofing sheets on compacted substrate with ends and edges lapped and stapled.
 - 1. Install a layer of waterproofing sheets under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls, and extend a minimum of 8 inches up or beyond perimeter slab forms.
- C. Concrete Walls: Starting at bottom of wall, apply waterproofing sheets horizontally against wall. Secure with masonry fasteners spaced according to manufacturer's written instructions. Extend to bottom of footing, grade beam, or wall, and secure.

D. Termination at Grade:

1. Extend waterproofing sheets to within 12 inches of finish grade unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.
2. Fasten top edge of waterproofing sheets to wall and protect top edge with sheet metal counterflashing. Cover waterproofing with a lapped course of plastic protection sheets if backfilling does not proceed immediately.

3.5 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels according to manufacturer's written instructions. Use adhesives or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed waterproofing installation before covering with other construction, and provide written report stating that installation complies with manufacturer's written instructions.
1. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.

END OF SECTION 071700

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SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.

B. Related Requirements:

1. Section 042200 "Concrete Unit Masonry" for insulation installed in masonry cells.
2. Section 061600 "Sheathing" for glass-mat gypsum sheathing to which extruded polystyrene board is adhered.
3. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic 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. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Research Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to

3. Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
 1. Manufacturers: Subject to compliance with requirements.
 - a. DiversiFoam Products
 - b. Owens Corning
 - c. The Dow Chemical Company
 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 and wider in width.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.3 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. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.
- C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.

- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
 - 2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.
 - 1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
 - 2. Press units firmly against inside substrates.
 - 3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. 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, 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.

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.

3.7 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

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SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Building wrap.

1.2 ACTION SUBMITTALS

- A. Product Data:
1. Building wrap.
- B. Product Data Submittals: For building wrap, include data on air and water-vapor permeance based on testing in accordance with referenced standards.

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For water-resistive barrier, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E2556/E2556M, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84; UV stabilized; and acceptable to authorities having jurisdiction.
1. Manufacturers: Subject to compliance with requirements:
 - a. Alpha ProTech
 - b. DuPont de Nemours, Inc.
 - c. Typar Geosynthetics; a PGI brand
 2. Water-Vapor Permeance: Minimum 50 perms per ASTM E96/E96M, Desiccant Method (Procedure A).
 3. Air Permeance: Maximum 0.004 cfm/sq. ft. at 0.3-inch wg when tested in accordance with ASTM E2178.
 4. Allowable UV Exposure Time: Not more than 120 days.
 5. Locations: At wood framed exterior walls as indicated on the Drawings.

3.1 INSTALLATION OF WATER-RESISTIVE BARRIER

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 - 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- C. Building Wrap or Drainage Wrap: Comply with manufacturer's written instructions and warranty requirements.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

END OF SECTION 072500

SECTION 072600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. 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: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D4397, 10-mil- thick sheet, with maximum permeance rating of 0.1 perm.

2.2 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Place vapor retarders on side of construction indicated on Drawings.
- B. 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.
- C. 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.
- D. 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.
- E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072600

SECTION 073113 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber-reinforced asphalt shingles.
2. Underlayment materials.
3. Ridge vents and static/gravity roof vents.
4. Metal flashing and trim.

1.2 ALTERNATES

- A. See Section 012300 "Alternates" for description of alternates affecting items specified under this Section.

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 for definitions of terms related to roofing Work in this Section.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Asphalt shingles.
2. Underlayment materials.
3. Roof ventilation.
4. Asphalt roofing cement.
5. Elastomeric flashing sealant.

- B. Samples: For each exposed product and for each color and blend specified, in sizes indicated.

1. Asphalt Shingles: Full size.

C. Samples for Initial Selection:

1. For each type of asphalt shingle indicated.
 - a. Remove (1) Existing shingle for comparison purposes, from area to be

removed and make area weather tight until final roof is installed.

2. For each type of accessory involving color selection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Research Reports: For synthetic underlayment, from an agency acceptable to authorities having jurisdiction, indicating that product is suitable for intended use under applicable building codes.
- C. Sample Warranty: For manufacturer's materials warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For asphalt shingles to include in maintenance manuals.
- B. Materials warranties.
- C. Roofing Installer's warranty.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized installer who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
- B. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double-stack rolls.
- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.
- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.

1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.10 WARRANTY

- A. Materials Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 2. Materials Warranty Period: Lifetime from date of Substantial Completion, prorated, with first five years nonprorated.
 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds of up to 80 mph for five years from date of Substantial Completion.
 4. Algae-Resistance Warranty Period: Asphalt shingles will not discolor for five years from date of Substantial Completion.
- B. Roofing Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

2.2 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.

2.3 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D3462/D3462M, laminated, multi-ply overlay construction; glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed; SAINT-GOBAIN
 - b. GAF/Elk
 - c. Owens Corning
 - 2. Strip Size: Manufacturer's standard.
 - 3. Algae Resistance: Granules resist algae discoloration.
 - 4. Color, Texture, and Blends: Match existing roof.
 - a. Existing Shingle: Elk Shingle Prestique High Definition Series.
- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.4 UNDERLAYMENT MATERIALS

- A. Organic Felt: Asphalt-saturated organic felts, nonperforated and complying with the following:
 - 1. ASTM D226/D226M: Type II.
- B. Ice & Water Shield: Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum 40-mil- thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed; SAINT-GOBAIN
 - b. GAF
 - c. Owens Corning

2.5 RIDGE VENTS AND STATIC VENTS

- A. Rigid Ridge Vent: Manufacturer's standard, rigid-section, high-density, UV-stabilized plastic ridge vent for use under ridge shingles.
 - 1. Basis of Design: Subject to compliance with requirements provide Air Vent, Inc.; Gibraltar Industries, Inc. products indicated on the Drawings or comparable product by one of the following:

- a. CertainTeed; SAINT-GOBAIN
 - b. Cor-A-Vent, Inc
 - c. GAF
 - d. Owens Corning
2. Minimum Net Free Area: As indicated on the Drawings.
 3. Width: As indicated on the Drawings.
- B. Static and Gravity Vent: Manufacturer's standard, aluminum static roof mounted vent.
1. Basis of Design: Subject to compliance with requirements provide Active Ventilation Products, Inc. products indicated on the Drawings or comparable product.
 2. Finish: Powder coat finish as selected by the Architect from the manufacturer's standard color selection.
 3. Minimum Net Free Area: As indicated on the Drawings.
 4. Size: As indicated on the Drawings.

2.6 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- diameter, sharp-pointed, with a 3/8- to 7/16-inch-diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through sheathing less than 3/4 inch 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- minimum diameter.

2.7 METAL FLASHING AND TRIM

- A. Sheet Metal: Aluminum, two-coat fluoropolymer finish. 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 specified in this Section or indicated on Drawings.
1. Apron Flashings: Fabricate with lower flange a minimum of 4 inches over and 4 inches beyond each side of downslope asphalt shingles and 6 inches up the vertical surface.

2. Step Flashings: Fabricate with a headlap of 2 inches and a minimum extension of 4 inches over the underlying asphalt shingle and up the vertical surface.
3. Counterflashings: Fabricate to cover 4 inches of base flashing measured vertically; and in lengths required so that no step exceeds 8 inches and overall length is no more than 10 feet.
 - a. Provide metal reglets for installation.
4. Drip Edges: Fabricate in lengths not exceeding 10 feet with minimum 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.
5. Vent-Pipe Flashings: ASTM B749, Type L51121, at least 1/16 inch 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 from pipe onto roof.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through asphalt shingles.
 3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Asphalt-Saturated Felt: Install on roof deck parallel with and starting at eaves and fasten with underlayment nails.
 1. Single-Layer Installation:

- a. Lap sides a minimum of 2 inches over underlying course.
 - b. Lap ends a minimum of 4 inches.
 - c. Stagger end laps between succeeding courses at least 72 inches.
 2. Install felt underlayment on roof deck not covered by self-adhering, polymer-modified bitumen sheet unless otherwise specified in this Section or indicated on Drawings.
 - a. Lap sides of felt over self-adhering sheet not less than 4 inches in direction that sheds water.
 - b. Lap ends of felt not less than 6 inches over self-adhering sheet.
 3. Install fasteners in a grid pattern of 12 inches between side laps with 6-inch spacing at side and end laps.
 4. Terminate felt extended up not less than 4 inches against sidewalls, curbs, chimneys, and other roof projections.
- C. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free, on roof deck.
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.
 - b. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses.
 - c. Roll laps with roller.
 3. Eaves: Extend from edges of eaves 36 inches beyond interior face of exterior wall.
 4. Rakes: Extend from edges of rakes 36 inches beyond interior face of exterior wall.
 5. Valleys: Extend from lowest to highest point 18 inches on each side of centerline.
 6. Hips: Extend 18 inches on each side.
 7. Ridges: Extend 36 inches on each side without obstructing continuous ridge vent slot.
 8. Sidewalls: Extend 18 inches beyond sidewalls and return vertically against sidewalls not less than 4 inches.
 9. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches beyond penetrating elements and return vertically against penetrating elements not less than 4 inches.
 10. Roof-Slope Transitions: Extend 18 inches on each roof slope.
 11. Cover underlayment within seven days.
 12. Sections of roofing less than 4:12 pitch.

3.3 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. Install metal flashings in accordance with recommendations in ARMA's "Asphalt

Roofing Residential Manual - Design and Application Methods" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."

2. Bed flanges of metal flashings using asphalt roofing cement or elastomeric flashing sealant.
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Step Flashings: Install with a headlap of 2 inches and extend over underlying shingle and up the vertical face.
 1. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying shingle.
 2. Fasten to roof deck only.
- D. Counterflashings: Coordinate with installation of base flashing and fit tightly to base flashing. Lap joints a minimum of 4 inches secured in a waterproof manner.
 1. Install in reglets or receivers.
- E. Rake Drip Edges: Install over underlayment materials and fasten to roof deck.
- F. Eave Drip Edges: Install below underlayment materials and fasten to roof deck.
- G. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 INSTALLATION OF ASPHALT SHINGLES

- A. Install asphalt shingles in accordance with manufacturer's written instructions and recommendations in ARMA's "Asphalt Roofing Residential Manual - Design and Application Methods" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.
 1. Extend asphalt shingles 1/2 inch over fasciae at eaves and rakes.
 2. Install starter strip along rake edge.
- C. Install first and remaining courses of laminated 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 five 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. When ambient temperature during installation is below 50 deg F, hand seal self-sealing asphalt shingles by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
- E. Ridge Vents: Install continuous ridge vents over asphalt shingles in accordance with manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- F. Static and Gravity Ventilator: Verify that ventilators operate properly and have unrestricted airflow. Clean, lubricate, and adjust operating mechanisms where applicable.
- G. Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing-shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds.
1. Fasten with roofing nails of sufficient length to penetrate sheathing.

END OF SECTION 073113

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SECTION 074646 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fiber-cement siding panels, trim and continuous aluminum soffit vents.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
 - 2. Section 072500 "Weather Barriers" for weather-resistive barriers.
 - 3. Section 099113 "Exterior Painting" for field painting of primed siding and soffits.

1.2 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Verification: For each type, color, texture, and pattern required.
 - 1. 12-inch- long-by-actual-width Sample of siding.
 - 2. 12-inch- long-by-actual-width Sample of soffit.
 - 3. 12-inch- long-by-actual-width Samples of trim and accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of fiber-cement siding, and, soffit.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.
- C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-

ES.

- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking and deforming.
 - b. Deterioration of materials beyond normal weathering.
 - 2. Warranty Period: 15 years for trim and 30 years for panels from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

- A. Fiber-Cement Siding: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide James Hardie, Hardie Panels; Sierra 8 (PNL-1), Select Cedarmill (PNL-2) and Hardie Trim Roughsawn or comparable product by one of the following:

- a. CertainTeed; SAINT-GOBAIN
- B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Nominal Thickness:
 - 1. Sierra 8 and Select Cedarmill panels 5/16 inch. Locations as indicated on the Drawings.
 - 2. Hardie Trim both $\frac{3}{4}$ inch and 1 inch as indicated on the Drawings.
- D. Factory Priming: Manufacturer's standard acrylic primer.

2.3 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
 - 1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.
- B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
 - 1. Corner posts.
 - 2. Door and window casings.
 - 3. Fasciae.
 - 4. Moldings and trim.
- C. Continuous soffit vents: Provide continuous soffit vents by Air Vent Inc., a Gibraltar Co., as indicated on the drawings or equal product.
- D. Flashing: Provide aluminum flashing where indicated.
 - 1. Finish for Aluminum Flashing: two-coat fluoropolymer. Color to be selected from manufacturer's standard color range.
- E. Fasteners:
 - 1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch into substrate.
 - 2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of $\frac{1}{4}$ inch, or three screw-threads, into substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding, and, soffit and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Do not install damaged components.
 - 2. Install fasteners no more than 24 inches o.c.
- B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

SECTION 07 5419 - POLYVINYL-CHLORIDE ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Duro-Last® Duro-Tuff™ membrane adhered with solvent-based adhesive.
- B. Duro-Guard® ISO III (tapered), attached with mechanical fasteners.
- C. Duro-Guard® ISO II (flat), loosely laid.
- D. Prefabricated flashings, corners, stacks, vents, and related details.
- E. Fasteners, adhesives, and other accessories required for a complete roofing installation.
- F. Traffic Protection.

1.2 REFERENCES

- A. NRCA - The NRCA Roofing and Waterproofing Manual.
- B. ASCE 7 - Minimum Design Loads For Buildings And Other Structures.
- C. UL - Roofing Materials and Systems Directory, Roofing Systems (TGFU.R10128).
- D. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- E. ASTM D 751 - Standard Test Methods for Coated Fabrics.
- F. ASTM D 4434 - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing.
- G. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.
- H. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.3 SYSTEM DESCRIPTION

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Physical Properties:
 - 1. Roof product must meet the requirements of Type III PVC sheet roofing as defined by ASTM D 4434 and must meet or exceed the following physical properties.
 - 2. Thickness: 60 mil, nominal, in accordance with ASTM D 751.

3. Thickness Over Scrim: ≥ 31 mil in accordance with ASTM D 751.
4. Breaking Strengths: ≥ 437 lbf. (MD) and ≥ 304 lbf. (XMD) in accordance with ASTM D 751, Grab Method.
5. Elongation at Break: $\geq 29\%$ (MD) and $\geq 30\%$ (XMD) in accordance with ASTM D 751, Grab Method.
6. Heat Aging in accordance with ASTM D 3045: 176 °F for 56 days. No sign of cracking, chipping or crazing. (In accordance with ASTM D 4434).
7. Factory Seam Strength: ≥ 463 lbf. in accordance with ASTM D 751, Grab Method.
8. Tearing Strength: ≥ 78 lbf. (MD) and ≥ 190 lbf. (XMD) in accordance with ASTM D 751, Procedure B.
9. Low Temperature Bend (Flexibility): Pass at -40 °F in accordance with ASTM D 2136.
10. Accelerated Weathering: No cracking, checking, crazing, erosion or chalking after 5,000 hours in accordance with ASTM G 154.
11. Linear Dimensional Change: $< 0.30\%$ (MD) and 0.10% (XMD) in accordance with ASTM D 1204 at 176 ± 2 °F for 6 hours.
12. Water Absorption: $< 2.29\%$ in accordance with ASTM D 570 at 158 °F for 166 hours.
13. Static Puncture Resistance: ≥ 33 lbs. in accordance with ASTM D 5602.
14. Dynamic Puncture Resistance: ≥ 14.7 ft-lbf. in accordance with ASTM D 5635.

D. Cool Roof Rating Council (CRRC):

1. Membrane must be listed on CRRC website.
 - a. Initial Solar Reflectance: $\geq 85\%$
 - b. Initial Solar Reflective Index (SRI): ≥ 108

E. Insulation

1. Provide overall thermal resistance for roofing system as follows:
 - a. Minimum R-value: 20.
2. Tapered Insulation Slope: 1/4 inch per foot.
3. Configuration as indicated on the Drawings.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Duro-Last data sheets on each product to be used, including:
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.

4. Maintenance requirements.
- C. Shop Drawings: Indicate insulation pattern, overall membrane layout, field seam locations, joint or termination detail conditions, and location of fasteners.
- D. Verification Samples: For each product specified, two samples, representing actual product, color, and finish.
 1. 4 inch by 6 inch sample of roofing membrane, of color specified.
 2. 4 inch by 6 inch sample of walkway pad.
 3. Termination bar, fascia bar with cover, drip edge and gravel stop if to be used.
 4. Each fastener type to be used for installing membrane, insulation/recover board, termination bar and edge details.
- E. Installer Certification: Certification from the roofing system manufacturer that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- F. Manufacturer's warranties.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with manufacturer's installation instructions.
- B. Manufacturer Qualifications: A manufacturer specializing in the production of PVC membranes systems and utilizing a Quality Control Manual during the production of the membrane roofing system that has been approved by and is inspected by Underwriters Laboratories.
- C. Installer Qualifications: Company specializing in installation of roofing systems similar to those specified in this project and approved by the roofing system manufacturer.
- D. Source Limitations: Obtain components for membrane roofing system from roofing membrane manufacturer.
- E. There shall be no deviations from the roof membrane manufacturer's specifications or the approved shop drawings without the prior written approval of the manufacturer.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for roof assembly wind uplift and fire hazard requirements.
 1. Conform to applicable code for roof assembly fire hazard requirements.
- B. Wind Uplift:
 1. Roofing System Design: Provide a roofing system designed to resist uplift pressures calculated according to the current edition of the ASCE-7 Specification *Minimum Design Loads for Buildings and Other Structures*.

1.7 PRE-INSTALLATION MEETING

- A. Convene meeting not less than one week before starting work of this section.
- B. Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 4. Review structural loading limitations of roof deck during and after roofing.
 - 5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 6. Review governing regulations and requirements for insurance and certificates if applicable.
 - 7. Review temporary protection requirements for roofing system during and after installation.
 - 8. Review roof observation and repair procedures after roofing installation.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Store roof materials and place equipment in a manner to avoid permanent deflection of deck.
- E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 WARRANTY

- A. Contractor's Warranty: The contractor shall warrant the roof application with respect to workmanship and proper application for two (2) years from the effective date of the

warranty issued by the manufacturer.

- B. Manufacturer's Warranty: Must be no-dollar limit type and provide for completion of repairs, replacement of membrane or total replacement of the roofing system at the then-current material and labor prices throughout the life of the warranty. In addition, the warranty must meet the following criteria:
 - 1. Warranty Period: 20 years from date issued by the manufacturer.
 - 2. Must provide positive drainage.
 - 3. No exclusion for damage caused by biological growth.
 - 4. Issued direct from and serviced by the roof membrane manufacturer.
 - 5. Transferable for the full term of the warranty.
 - 6. Maintain existing Durolast roofing warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer: Duro-Last Roofing, Inc., which is located at: 525 Morley Drive, Saginaw, MI 48601. Telephone: 800-248-0280.
- B. All roofing system components to be provided or approved by Duro-Last Roofing, Inc.
- C. Substitutions: Not permitted.

2.2 ROOFING SYSTEM COMPONENTS

- A. Roofing Membrane: Duro-Last® Duro-Tuff™ membrane conforming to ASTM D 4434, type III, fabric-reinforced, PVC, NSF/ANSI 347 Gold or Platinum Certification, and a product-specific third-party verified Environmental Product Declaration. Membrane properties as follows:
 - 1. Thickness:
 - a. 60 mil, nominal.
 - 2. Exposed Face Color:
 - a. White.
 - 3. Minimum recycle content 7% post-industrial and 0% post-consumer.
 - 4. Recycled at end of life into resilient flooring or concrete expansion joints.
- B. Accessory Materials: Provide accessory materials supplied by or approved for use by Duro-Last Roofing, Inc.
 - 1. Sheet Flashing: Manufacturer's standard reinforced PVC sheet flashing.
 - 2. Duro-Last Factory Prefabricated Flashings: manufactured using Manufacturer's standard reinforced PVC membrane.
 - a. Stack Flashings.

- b. Curb Flashings.
 - c. Inside and Outside Corners.
 - d. Vinyl Coated Metal Scupper Inserts.
 - e. Vinyl Coated Pitch Pans.
3. Sealants and Adhesives: Compatible with roofing system and supplied by Duro-Last Roofing, Inc.
 - a. Duro-Caulk® Plus.
 - b. Strip Mastic.
 4. Slip Sheet: Compatible with roofing system and supplied by Duro-Last Roofing, Inc.
 5. Fasteners and Plates: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane and insulation to substrate. Supplied by Duro-Last Roofing, Inc.
 - a. #14 Heavy Duty Fasteners.
 - b. 3 inch Metal Plates.
 6. PV Anchors
 7. Termination and Edge Details: Supplied by Duro-Last Roofing, Inc.
 - a. Termination Bar.
 - b. Universal 2-Piece Compression Metal System.
 - c. Vinyl Coated Metal Drip Edge.
 - d. Snap Coping.
 8. Vinyl Coated Metal: Supplied by Duro-Last Roofing, Inc. 24 gauge, hot-dipped galvanized, grade 90 metal with a minimum of 17 mil of Duro-Last membrane laminated to one side.
- C. Walkways:
1. Provide non-skid, maintenance-free walkway pads in areas of heavy foot traffic and around mechanical equipment. Refer to the roof plan on the drawings for specific walkway pad locations.
 - a. Duro-Last Roof Trak® III Walkway Pad.

2.3 ROOF INSULATION

A. General:

1. Provide preformed roof insulation boards that comply with requirements and referenced standards, as selected from manufacturer's standard sizes.
2. Provide preformed saddles, crickets, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

B. Polyisocyanurate Board Insulation: Complying with ASTM C 1289, Type II, felt or glass-

fiber mat facer on both major surfaces. Material as supplied by Duro-Last.

1. Duro-Guard® ISO II (flat).
2. Duro-Guard® ISO III (flat or tapered).

2.4 ROOF INSULATION ACCESSORIES

- A. General: Provide roof insulation accessories approved by the roof membrane manufacturer and as recommended by insulation manufacturer for the intended use.
- B. Fasteners: Provide Duro-Last factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening insulation and/or insulation cover boards in conformance to specified design requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that the surfaces and site conditions are ready to receive work.
- B. Verify that the deck is supported and secured.
- C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.
- D. Verify that the deck surfaces are dry and free of standing water, ice or snow.
- E. Verify that all roof openings or penetrations through the roof are solidly set.
- F. If substrate preparation is the responsibility of another contractor, notify Architect of unsatisfactory preparation before proceeding.

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. Surfaces shall be clean, smooth, free of fins, sharp edges, loose and foreign material, oil, grease, and bitumen.

3.3 INSTALLATION

- A. Install insulation in accordance with the roof manufacturer's requirements.
- B. Insulation: Duro-Guard® ISO II (flat) and Duro-Guard® ISO III (tapered).
 1. Install insulation in accordance with the roof manufacturer's requirements.
 2. Insulation shall be adequately supported to sustain normal foot traffic without damage.
 3. Where field trimmed, insulation shall be fitted tightly around roof protrusions with no gaps greater than 1/4 inch.

4. Tapered insulation boards shall be installed in accordance with the insulation manufacturer's shop drawings.
 5. No more insulation shall be applied than can be covered with the roof membrane by the end of the day or the onset of inclement weather.
 6. If more than one layer of insulation is used, all joints between subsequent layers shall be offset by at least 6 inches.
 7. Mechanical Attachment: Use only fasteners, stress plates and fastening patterns accepted for use by the roof manufacturer. Fastening patterns must meet applicable design requirements.
 - a. Install fasteners in accordance with the roof manufacturer's requirements. Fasteners that are improperly installed must be replaced or corrected.
 8. Loosely lay Duro-Guard® ISO II (flat) and then overlay with Duro-Guard® ISO III (tapered). Install mechanical fasteners through top layer to attach insulation. Install all layers in parallel courses with end joints staggered 50% and adjacent boards butted together with no gaps greater than 1/4 inch.
- C. Roof Membrane: 60 mil, nominal, Duro-Last® Duro-Tuff™ membrane.
1. Use only membrane adhesive acceptable to the roof manufacturer's that meets the applicable design requirements.
 - a. Solvent-based membrane adhesive.
 2. Cut membrane to fit neatly around all penetrations and roof projections.
 3. Unroll roofing membrane and positioned with a minimum 6 inch overlap.
 4. Apply adhesive in accordance with the roof manufacturer's requirements.
 - a. Apply at the required rate in smooth, even coatings without voids, globs, puddles or similar irregularities. Use care not to contaminate the area of the membrane where hot air welding will occur.
 5. Apply adhesive to both the substrate and the bottom side of roof membrane.
 6. Follow guidelines outlined in the adhesive's Product Data Sheet.
 7. Read the adhesive's Material Safety Data Sheet (MSDS) prior to using the adhesive.
- D. Seaming:
1. Weld overlapping sheets together using hot air. Minimum weld width is 1-1/2 inches.
 2. Check field welded seams for continuity and integrity and repair all imperfections by the end of each work day.
- E. Membrane Termination/Securement: All membrane terminations shall be completed in accordance with the membrane manufacturer's requirements.
1. Provide securement at all membrane terminations at the perimeter of each roof level, roof section, curb flashing, skylight, expansion joint, interior wall, penthouse, and other similar condition.
 2. Provide securement at any angle change where the slope or combined slopes exceeds

two inches in one horizontal foot.

- F. Flashings: Complete all flashings and terminations as indicated on the drawings and in accordance with the membrane manufacturer's requirements.
1. Provide securement at all membrane terminations at the perimeter of each roof level, roof section, curb flashing, skylight, expansion joint, interior wall, penthouse, and other similar condition.
 - a. Do not apply flashing over existing thru-wall flashings or weep holes.
 - b. Secure flashing on a vertical surface before the seam between the flashing and the main roof sheet is completed.
 - c. Extend flashing membrane a minimum of 6 inches (152 mm) onto the main roof sheet beyond the mechanical securement.
 - d. Use care to ensure that the flashing does not bridge locations where there is a change in direction (e.g. where the parapet meets the roof deck).
 2. Penetrations:
 - a. Flash all pipes, supports, soil stacks, cold vents, and other penetrations passing through the roofing membrane as indicated on the Drawings and in accordance with the membrane manufacturer's requirements.
 - b. Utilize custom prefabricated flashings supplied by the membrane manufacturer.
 - c. Existing Flashings: Remove when necessary to allow new flashing to terminate directly to the penetration.
 3. Pipe Clusters and Unusual Shapes:
 - a. Clusters of pipes or other penetrations which cannot be sealed with prefabricated membrane flashings shall be sealed by surrounding them with a prefabricated vinyl-coated metal pitch pan and sealant supplied by the membrane manufacturer.
 - b. Vinyl-coated metal pitch pans shall be installed, flashed and filled with sealant in accordance with the membrane manufacturer's requirements.
 - c. Pitch pans shall not be used where prefabricated or field fabricated flashings are possible.
- G. Edge Details:
1. Provide edge details as indicated on the Drawings. Install in accordance with the membrane manufacturer's requirements.
 2. Join individual sections in accordance with the membrane manufacturer's requirements.
 3. Coordinate installation of metal flashing and counter flashing specified in Section 07620.
 4. Manufactured Roof Specialties: Coordinate installation of copings, counter flashing systems, gutters, downspouts, and roof expansion assemblies specified in Section 07710.
- H. Walkways:
1. Install walkways in accordance with the membrane manufacturer's requirements.

2. Provide walkways where indicated on the Drawings.
 3. Install walkway pads at roof hatches, access doors, rooftop ladders and all other traffic concentration points regardless of traffic frequency. Provided in areas receiving regular traffic to service rooftop units or where a passageway over the surface is required.
 4. Do not install walkways over flashings or field seams until manufacturer's warranty inspection has been completed.
- I. Water cut-offs:
1. Provide water cut-offs on a daily basis at the completion of work and at the onset of inclement weather.
 2. Provide water cut-offs to ensure that water does not flow beneath the completed sections of the new roofing system.
 3. Remove water cut-offs prior to the resumption of work.
 4. The integrity of the water cut-off is the sole responsibility of the roofing contractor.
 5. Any membrane contaminated by the cut-off material shall be cleaned or removed.

3.4 FIELD QUALITY CONTROL

- A. The membrane manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors shall be addressed and final punch list completed.

3.5 PROTECTION

- A. Protect installed roofing products from construction operations until completion of project.
- B. Where traffic is anticipated over completed roofing membrane, protect from damage using durable materials that are compatible with membrane.
- C. Repair or replace damaged products after work is completed.

END OF SECTION 075419

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof-edge specialties.
2. Roof-edge drainage systems.
3. Reglets and counterflashings.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for downspout guards and downspout boots.
2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 073113 "Asphalt Shingles" for exposed flashing conditions.
4. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.7 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 073113 "Asphalt Shingles" .
- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 073113 "Asphalt Shingles."

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface

temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.3 ROOF-EDGE SPECIALTIES

A. One-Piece Gravel Stops: Manufactured, one-piece, metal gravel stop in section lengths not exceeding 12 feet, with profile to allow flat roof to drain across transition to sloped shingle roof to gutters below. Conceal splices and provide matching corner units.

1. Formed Aluminum Sheet Gravel Stops: Aluminum sheet, 0.040 inch thick. Compatible with both asphalt shingles and PVC roofing.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Match existing.
 - c. Color: Match existing.
 - d. Profile: Match existing.
2. Corners: Factory mitered and mechanically clinched and sealed watertight.

2.4 ROOF-EDGE DRAINAGE SYSTEMS

A. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Aluminum Sheet: 0.032 inch thick.
2. Gutter Profile: Style F to match existing according to SMACNA's "Architectural Sheet Metal Manual."
3. Corners: Factory mitered and mechanically clinched and sealed watertight.
4. Gutter Supports: Spikes and ferrules with finish matching the gutters.
5. Gutter Accessories: Continuous screened leaf guard with sheet metal frame.

B. Downspouts: Plain rectangular to match existing complete with machine-crimped elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Formed Aluminum: 0.032 inch thick.

C. Aluminum Finish: Two-coat fluoropolymer, match existing.

2.5 REGLETS AND COUNTERFLASHINGS

- A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
 - 1. Formed Aluminum: 0.024 inch thick.
 - 2. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- B. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets, or, through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
 - 1. Formed Aluminum: 0.024 inch thick.
- C. Accessories:
 - 1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
 - 2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- D. Aluminum Finish: Two-coat fluoropolymer.
 - 1. Color: Match existing.

2.6 MATERIALS

- A. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

2.7 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
- B. Elastomeric Sealant: ASTM C920, elastomeric polyurethane, silicone polymer sealant of

type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

- C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- D. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Coil-Coated Aluminum Sheet Finishes:
 - 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.3 INSTALLATION OF ROOF-EDGE SPECIALITIES

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.4 INSTALLATION OF ROOF-EDGE DRAINAGE SYSTEMS

- A. Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 12 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.
 - 2. Install continuous leaf guards on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
 - 1. Connect downspouts to underground drainage system indicated.
- D. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below gutter discharge.

3.5 INSTALLATION OF REGLETS AND COUNTERFLASHINGS

- A. Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.
- C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.6 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 and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in

a clean condition during construction.

- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.

B. Related Requirements:

1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with listed system designs published by a qualified testing agency.
 - 1) UL in its online directory "Product iQ."

2.3 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems are to be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Manufacturers: Subject to compliance with requirements, :
 - a. 3M Building and Construction
 - b. Balco; a CSW Industrials Company
 - c. Hilti, Inc.
 - d. Specified Technologies Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings

determined per ASTM E814 or UL 1479.

1. F-Rating: Not less than the fire-resistance rating of the wall penetrated.
 2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.
- C. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
1. Sealant shall have a VOC content of 250 g/L or less.
 2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 5. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials.
 2. Substrate primers.
 3. Collars.
 4. Steel sleeves.

2.4 FILL MATERIALS

- A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure

during exposure to moisture.

- B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- D. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric strips for use around combustible penetrants.
- F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- G. Pillows/Bags: Compressible, removable, and reusable intumescent pillows encased in fire-retardant polyester or glass-fiber cloth. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.
- J. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use around rectangular steel HVAC ducts without fire dampers.
- K. Firestop Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.
- L. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to 1/2 inch diameter.
- M. Closet Flange Gasket: Molded, single-component, flexible, intumescent gasket for use beneath a water closet (toilet) flange in floor applications.
- N. Endothermic Wrap: Flexible, insulating, fire-resistant, endothermic wrap for protecting membrane penetrations of utility boxes, critical electrical circuits, communications lines, and fuel lines.

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.

3.3 INSTALLATION OF PENETRATION FIRESTOPPING SYSTEMS

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
2. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with Listed System Designs published by a qualified testing agency.
 - 1) UL in its online directory "Product iQ."

2.3 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
 - 1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
 - 2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
 - 3. Provide firestop products that do not contain ethylene glycol.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.

1. Manufacturers: Subject to compliance with requirements, :
 - a. 3M Building and Construction
 - b. Balco; a CSW Industrials Company
 - c. Hilti, Inc.
 - d. Specified Technologies Inc.
 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
1. Sealant shall have a VOC content of 250 g/L or less.

2.4 ACCESSORIES

- A. Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.

- B. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition occurs, such as the intersection of a gypsum wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.

3.3 INSTALLATION

- A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
 - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. from end of wall and at intervals not exceeding 30 ft.
- B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.

4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION 078443

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SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Silane-modified polymer joint sealants.
3. Mildew-resistant joint sealants.
4. Latex joint sealants.

B. Related Requirements:

1. Section 042200 "Concrete Unit Masonry" and 042613 "Masonry Veneer" and 044313.13 "Anchored Stone Masonry Veneer" for masonry control and expansion joint fillers and gaskets.
2. Section 088000 "Glazing" for glazing sealants.
3. Section 092900 "Gypsum Board" for sealing perimeter joints and installation of acoustical sealant.
4. Section 095113 "Acoustical Panel Ceilings" for installation of acoustical sealant.
5. Civil Engineering drawings and specification notes for sealing joints in paved roads, parking lots, walkways, and curbing.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Silane-modified polymer joint sealants.
4. Mildew-resistant joint sealants.
5. Latex joint sealants.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

- A. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
 - 1. Joint-sealant location and designation.
 - 2. Manufacturer and product name.
 - 3. Type of substrate material.
 - 4. Proposed test.
 - 5. Number of samples required.
- B. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested from sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
- C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- D. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.
- E. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Manufacturers' special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.

2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer.

2.2 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco Incorporated, Spectrem 2 or comparable product by one of the following:
 - a. Pecora Corporation
 - b. Sika Corporation - Building Components
 - c. The Dow Chemical Company

2.4 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

2.5 SILANE-MODIFIED POLYMER JOINT SEALANTS

- A. Silane-Modified Polymer, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco Incorporated, Dymonic FC or comparable product by one of the following:
 - a. Master Builders Solutions; brand of MBCC Group
 - b. Sika Corporation - Building Components

2.6 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco Incorporated, Tremsil 200 or comparable product by one of the following:
 - a. Pecora Corporation
 - b. Sika Corporation - Building Components
 - c. The Dow Chemical Company

2.7 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco Incorporated, Tremflex 834 or comparable product by one of the following:
 - a. Pecora Corporation
 - b. PPG Paints; PPG Industries, Inc.
 - c. Sherwin-Williams Company (The)

2.8 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.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- 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.

2.9 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of

joint sealants as applicable to materials, applications, and conditions indicated.

- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - a. Extent of Testing: Test completed and cured sealant joints as follows:
 - 1) Perform 10 tests for the first 1000 ft. of joint length for each kind of sealant and joint substrate.
 - 2) Perform one test for each 1000 ft. of joint length thereafter or one test per each floor per elevation.

- b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - c. Inspect tested joints and report on the following:
 - 1) Whether sealants filled joint cavities and are free of voids.
 - 2) Whether sealant dimensions and configurations comply with specified requirements.
 - 3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 - d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 - 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.
- B. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or

deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

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SECTION 079513.16 - EXTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior expansion joint covers (Fire rated and non-fire rated).

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

B. Samples for Initial Selection: For each type of exposed finish.

1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079, or, ASTM

E1966 by a qualified testing agency.

1. Hose Stream Test: Wall-to-wall and wall-to-soffit assemblies shall be subjected to hose stream testing.

B. Expansion Joint Design Criteria:

1. Type of Movement: Thermal.
 - a. Nominal Joint Width: As indicated on Drawings.

2.3 EXTERIOR EXPANSION JOINT COVERS

A. Preformed Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties Inc., VFR (fire rated) and VF (non-fire rated) or comparable product by one of the following:
 - a. Balco; a CSW Industrials Company
 - b. Nystrom, Inc.
 - c. Pecora Corporation
2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: As indicated on Drawings.
3. Joint Seal Color: As selected by Architect from full range of industry colors.

2.4 MATERIALS

- A. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.
- B. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.
- C. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

2.5 ACCESSORIES

- A. Manufacturer's standard attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- B. Preformed Foam Joint Seals: Install in compliance with manufacturer's written instructions. Install with minimum number of end joints.
 - 1. Install each length of seal immediately after removing protective wrapping.
 - 2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
 - 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.

4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.
- C. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
- D. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.
- E. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
 1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

3.4 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections.

END OF SECTION 079513.16

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Light frames and glazing installed in hollow metal doors.

- B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section "Flush Wood Doors".
4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
5. Division 08 Section "Door Hardware".
6. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
7. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.

- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.

6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Doors Under Specified Pressure Differences Across the Specimens.
11. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
12. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
13. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
14. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
15. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
16. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
17. NFRC 102 – Procedure for Measuring the Steady State Thermal Transmittance of Fenestration Systems.
18. NFRC 400 – Procedure for Determining Fenestration Product Air Leakage.
19. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
20. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.

7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
 1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:

- a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.37, R-Value 2.7, including insulated door, thermal-break frame and threshold.
 2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
 - a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).
 - F. Sound Transmission Class (STC) Rated Doors: Provide sound transmission class rated doors fabricated as sound-reducing types with testing according to ASTM E 90, and classifications according to ASTM E 413. Submit manufacturer's written results of STC ratings from testing performed by a qualified independent testing agency for sound resistant doors.
 - G. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
 - B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
 - C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.
- 1.6 PROJECT CONDITIONS
- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.
- 1.7 COORDINATION
- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts,

anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

- B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).
 - 3. Steelcraft (S).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with

requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.

1. Design: Flush panel.
 2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
 - b. Thermal properties to rate at a fully operable minimum U-Factor 0.37 and R-Value 2.7, including insulated door, thermal-break frame and threshold.
 - c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.38 and R-Value 2.6, including insulated door, kerf type frame, and threshold.
 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053 inch - 1.3-mm) thick steel, Model 2.
 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.

5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. Curries Company (CU) - Polystyrene Core - 707 Series.
2. Curries Company (CU) - Energy Efficient - 777 Trio-E Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16" positive thermal break and integral vinyl weatherstripping.

C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. Curries Company (CU) – Thermal Break TQ Series.

D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. Curries Company (CU) - CM Series.

b. Curries Company (CU) - M Series.

E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations

so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
5. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.

7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
 - a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
 - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
 - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
 - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
9. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
10. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
11. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
12. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT,

tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 - 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jamb and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air

drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Solid core doors with wood veneer faces.
2. Factory finishing wood doors.
3. Factory fitting wood doors to frames and factory machining for hardware.
4. Light frames and glazing installed in wood doors.

- B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 08 Section "Hollow Metal Doors and Frames".
3. Division 08 Section "Glazing".
4. Division 08 Section "Door Hardware".

- C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI A208.1 – Wood Particleboard.
3. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
4. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
5. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
6. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
7. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A classifications. Include factory finishing specifications.
- B. Shop Drawings shall include:
 - 1. Indicate location, size, and hand of each door.
 - 2. Indicate dimensions and locations of mortises and holes for hardware.
 - 3. Indicate dimensions and locations of cutouts.
 - 4. Indicate requirements for veneer matching.
 - 5. Indicate location and extent of hardware blocking.
 - 6. Indicate construction details not covered in Product Data.
 - 7. Indicate doors to be factory finished and finish requirements.
 - 8. Indicate fire protection ratings for fire rated doors.
- C. Samples for Initial Selection: For factory finished doors.
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
 - 2. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - a. Provide samples for each species of veneer and core material.
 - b. Finish veneer faced door samples with same materials proposed for factory finished doors.
 - 3. Frames for light openings, 6 inches long, for each material, type, and finish required.
- D. Warranty: Provide sample of manufacturer's warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors".
- C. Fire Rated Wood Doors: Doors 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 at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL10C.

1. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer's construction label, indicating compliance to independent 3rd party certification agency's procedure, except for size.
2. Temperature Rise Limit: Where required and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - 1) Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

- D. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package pre-finished doors individually in plastic bags and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.

- b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 DOOR CONSTRUCTION – GENERAL

- A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium.
- B. Fire Rated Doors: Provide construction and core as needed to provide fire ratings indicated.
 1. Category A Edge Construction: Provide fire rated door edge construction with intumescent seals concealed by outer stile (Category A) at 45, 60, and 90 minute rated doors. Comply with specified requirements for exposed edges.
 2. Pairs: Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - a. Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals.
 - b. Where required for concealed hardware, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.

2.2 CORE CONSTRUCTION

- A. Structural Composite Lumber Core Doors:
 1. Structural Composite Lumber: Engineered hardwood composite wood products tested in accordance with WDMA I.S.1A, Testing Cellulosic Composite Materials for Use in Fenestration Products containing no added Urea Formaldehyde.
- B. Particleboard Core Doors:
 1. Particleboard: Wood fiber based materials complying with ANSI A208.1 Particleboard standard. Grade LD-2.
 2. Adhesive: Fully bonded construction using Polyurethane (PUR) glue.

3. Blocking: As indicated under article “Blocking”.

C. Fire Resistant Composite Core Doors:

1. Core: Non-combustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire protection rating indicated.
2. Blocking: As indicated under article “Blocking”.
3. Edge Construction: At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 BLOCKING

A. Fire Rated Doors:

1. Provide blocking as indicated below:
 - a. HB1: 5 inch in doors indicated to have closers and overhead stops.
 - b. HB7: 5 inch stile blocking.

2.4 VENEERED DOORS FOR TRANSPARENT FINISH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Marshfield-Algoma: Signature Series.
2. Mohawk: Cendura Series.
3. VT Industries: Artistry Series.

B. Interior Solid Core Doors:

1. Grade: Premium.
2. Faces: Veneer grades as noted below; veneer minimum 1/50-inch (0.5mm) thickness at moisture content of 12% or less.
 - a. Manufacturer Standard Face: as selected by architect/owner.
 - b. Plain Sliced Select White Birch, AA grade faces.
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces:
 - a. Balance match.

5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Transom Match: Continuous match.
7. Vertical Edges: Matching same species as faces. Wood or composite material, one piece, laminated, or veneered. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.
8. Horizontal Edges: Solid wood or structural composite material meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.
10. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.

2.5 LIGHT FRAMES AND GLAZING

- A. Wood Beads for Light Openings in Wood Doors up to and including 20-minute rating:
 1. Wood Species: Same species as door faces.
 2. Profile:
 - a. M1 Flush Bead.
 - b. At wood core doors with 20-minute fire protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Light Openings in Fire Rated Doors over 20-minute Rating: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.
 1. Manufacturers:
 - a. Air Louver (LV).
 - b. All Metal Stamping (AP).
 - c. Pemko (PE).
- C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

2.6 FABRICATION

- A. Factory fit doors to suit frame opening sizes indicated.
 - 1. Comply with requirements in NFPA 80 for fire rated doors.
 - 2. Undercut: As required per manufacturer's templates and sill condition.
- B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - 2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.
- C. Openings: Cut and trim openings through doors in factory.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.
- D. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Division 08 "Door Hardware". Wire nut connections are not acceptable.

2.7 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Transparent Finish: Provide a clear protective coating over the wood veneer allowing the natural color and grain of the selected wood species to provide the appearance specified. Stain is applied to the wood surface underneath the transparent finish to add color and design flexibility.
 - 1. Finish: Meet or exceed WDMA I.S. 1A TR8 UV Cured Acrylated Polyester finish performance requirements.
 - 2. Staining:

- a. As selected by Architect from manufacturer's full range.
3. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Installation Instructions: Install doors and frames to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.
- C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- E. Field modifications to doors shall not be permitted, except those specifically allowed by manufacturer or fire rating requirements.

3.3 ADJUSTING

- A. Operation: Re-hang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.

B. Related Requirements:

1. Section 113300 "Retractable Stairs" for attic access.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Babcock-Davis
 - b. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
 - c. Larsen's Manufacturing Company
 - d. Milcor by Duravent; Duravent Group.
2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Locations: Ceiling and attic draft stopping barriers.
4. Door Size: As indicated on the Drawings.
5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
6. Frame Material: Same material, thickness, and finish as door.
7. Latch and Lock: Cam latch, screwdriver operated, with interior release.

8. Operation: Doors in attic draft stopping barriers to be self-closing in addition to latching.

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- D. Latch and Lock Hardware:
 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal

primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

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SECTION 083313 - COILING COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Counter door assemblies.

B. Related Requirements:

1. Section 087100 "Door Hardware" for lock cylinder.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For coiling counter doors to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain coiling counter doors from single source from single manufacturer.

2.2 COUNTER DOOR ASSEMBLY

- A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
 - a. Cookson; a CornellCookson company
 - b. Cornell; a CornellCookson company
 - c. McKeon Door Company
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Door Curtain Material: Galvanized steel.
- D. Door Curtain Slats: Flat profile slats of 1-1/2-inch center-to-center height.
- E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated hot-dip galvanized steel and finished to match door.
- F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- G. Hood: Galvanized steel.
 - 1. Shape: Square.
 - 2. Mounting: Face of wall.
- H. Sill Configuration: No sill.
- I. Locking Devices: Equip door with locking device assembly.
 - 1. Locking Device Assembly: Masterkeyable cylinder lock operable from coil side bottom bar.
- J. Manual Door Operator: Push-up operation.
- K. Curtain Accessories: Equip door with pole hook.
- L. Door Finish:
 - 1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2.3 DOOR CURTAIN MATERIALS AND FABRICATION

- A. Door Curtains: Fabricate coiling counter door curtain of interlocking metal slats in a

continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.4 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.

2.5 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: As specified in Section 087100 "Door Hardware", and keyed to building keying system.
2. Keys: Three for each cylinder.

2.6 CURTAIN ACCESSORIES

A. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

B. Pole Hooks: Provide pole hooks and poles for doors more than 84 inches high.

2.7 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained

in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

- B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install coiling counter doors and operating equipment complete with necessary hardware,

anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

- B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

END OF SECTION 083313

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SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Aluminum-framed storefront systems.
 2. Aluminum-framed entrance door systems.

1.2 ALTERNATES

- A. See Section 012300 "Alternates" for description of alternates affecting items specified under this Section.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 4. Include point-to-point wiring diagrams showing the following:
 - a. Power requirements for each electrically operated door hardware.
 - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates:

- 1. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 - a. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

B. Test and Evaluation Reports:

- 1. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by qualified testing agency.

C. Source Quality-Control Submittals:

- 1. Source quality-control reports.

D. Field Quality-Control Submittals:

- 1. Field quality-control reports.

E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For aluminum-framed entrances and storefronts.

1.6 QUALITY ASSURANCE

A. Qualifications:

- 1. Installers: 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 (AG&M) contractors.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

- 1. Do not change intended aesthetic effects, as judged solely by Architect, except with

Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures, including, but not limited to, excessive deflection.
- b. Noise or vibration created by wind and thermal and structural movements.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- d. Water penetration through fixed glazing and framing areas.
- e. Failure of operating components.

2. Warranty Period: Ten years for anodized products and twenty years for painted finishes 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 factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
- b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this

Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.

C. 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 and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
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.

D. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. 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, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

F. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
 2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- G. Energy Performance: Certified and labeled 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 0.45 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 - b. Entrance Doors: U-factor of not more than 0.68 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 2. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.
 - b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 3. 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.
 - b. Entrance Doors: CRF of not less than 57 as determined in accordance with AAMA 1503.
- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F.
 - c. Interior Ambient-Air Temperature: 75 deg F.

2.3 STOREFRONT SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide EFCO Corporation, System 403, 401 and D-300 to match existing building.
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Exterior Framing Construction: Thermally broken.
 - 2. Interior Vestibule Framing Construction: Nonthermal.
 - 3. Glazing System: Retained mechanically with gaskets on four sides.
 - 4. Glazing Plane: Center.
 - 5. Finish: Color anodic finish as indicated on the drawings.
 - 6. Finish: High-Performance Organic Finish, Two-Coat PVDF finish as indicated on the drawings.
 - 7. Fabrication Method: Field-fabricated stick system.
 - 8. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 9. Steel Reinforcement: As required by manufacturer.
 - 10. Expansion: Provide expansion mullion per manufacturer's requirements.
- C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Applications: Use 403 storefront at all exterior locations and 401 at all interior locations. Use D-300 doors at both interior and exterior locations. Exterior locations to have 1" insulated glazing per the Glazing Schedule in Section 088000 "Glazing." Interior locations to have 1/4 inch single pane glazing (tempered where required).

2.4 ENTRANCE DOOR SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide EFCO Corporation, Series D-300 Medium Stile Doors to match existing.
- B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
 - 1. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
 - 2. Finish: Match adjacent storefront framing finish.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware is specified in Section 087100 "Door Hardware."

2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

2.7 ACCESSORIES

- A. Automatic Door Operators: Section 084229.33 "Swinging Automatic Entrances."
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
- C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
- F. Rigid PVC filler.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from interior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using screw-spline system.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
- G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.9 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.
- B. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

3.4 INSTALLATION OF WEATHERSEAL SEALANT

- A. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.5 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

- A. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.6 ERECTION TOLERANCES

- A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 084113

SECTION 085200 - WOOD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes aluminum-clad wood windows.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for wood windows.
- B. Shop Drawings: For wood windows.
 - 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Product Schedule: For wood windows. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each type of wood window, for tests performed by a qualified testing agency.
- C. Sample Warranties: For manufacturer's warranties.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

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. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 - 2. Warranty Period:
 - a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: Five years from date of Substantial Completion.
 - c. Aluminum-Cladding Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain wood windows from single source from single manufacturer.

2.2 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.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: CW.
 - 2. Minimum Performance Grade: 30.
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40.
- E. Sound Transmission Class (STC): Rated for not less than 26 STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

- F. Outside-Inside Transmission Class (OITC): Rated for not less than 22 OITC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.

2.3 WOOD WINDOWS

A. Aluminum-Clad Wood Windows:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Pella Corporation, Designer Series, Fixed Casement Window Units.

B. 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 deep by 2 inches wide; water-repellent preservative treated.

- 1. Exterior Finish: Aluminum-clad wood.
 - a. Aluminum Finish: Manufacturer's standard baked-on enamel finish.
 - b. Color: Two colors: Bronze and Tan. Location as indicated on the Drawings.
- 2. Interior Finish: Unfinished.
 - a. Exposed Unfinished Wood Surfaces: Manufacturer's standard species.

C. Insulating-Glass Units: ASTM E2190.

- 1. Glass: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: Clear.
 - b. Kind: Fully tempered where indicated on Drawings.
- 2. Manufacturer's Standard Insulshield Advanced Low-E Insulating Glass panel with argon.
- 3. Integral Louver Blinds: Glass manufacturer's standard, horizontal louver blinds with aluminum slats and polyester fiber cords, located in space between glass lites, and operated by hardware located on inside face of sash.
 - a. Color: As selected by Architect from manufacturer's full range.

D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

E. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.
- F. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- G. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 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. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 E2112.

- 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.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
 - 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085200

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SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. 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. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 4. Division 08 Section "Automatic Door Operators".
- 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. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
 - 8. 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. Shop Drawings: Details of electrified access control hardware indicating the following:
 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access

control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

- a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during

the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- E. Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through the Norton Preferred Installer (NPI) program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.
- F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- H. 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.
- I. 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
- J. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

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 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) - BB Series, 5 knuckle.
 - b. Ives (IV) - 5BB Series, 5 knuckle.
 - c. McKinney (MK) - TA/T4A Series, 5 knuckle.
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
1. Manufacturers:.
- a. Ives (IV).
 - b. Pemko (PE).
 - c. Select Hinges (SL).
- C. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should conform with ANSI/BHMA A156.14.
1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
2. Manufacturers:
- a. Hafele Manufacturing (HF).
 - b. Johnson Hardware (JO).
 - c. Pemko (PE).

2.3 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Manufacturers:

- a. Hager Companies (HA) - ETW-QC (# wires) Option.
 - b. Ives (IV) - Connect.
 - c. McKinney (MK) - QC (# wires) Option.
- B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Manufacturers:
 - a. Pemko (PE) - EL-CEPT Series.
 - b. Securitron (SU) - EL-CEPT Series.
 - c. Von Duprin (VD) - EPT-10 Series.
- C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney (MK) - Connector Hand Tool: QC-R003.
 2. Manufacturers:
 - a. Hager Companies (HA) - Quick Connect.
 - b. McKinney (MK) - QC-C Series.
 - c. Dormakaba Best (ST) - WH Series.
- 2.4 DOOR OPERATING TRIM
- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
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. Burns Manufacturing (BU).
 - b. Ives (IV).
 - c. Rockwood (RO).

- B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
 1. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Ives (IV).
 - c. Rockwood (RO).

- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units 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. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 6. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Ives (IV).
 - c. Rockwood (RO).

- D. Locking Pull System: Post-mount style door pulls with integrated deadbolt locking system in type and design as specified in the Hardware Sets. Pulls available in multiple head, floor, or combination locking options, with outside keyed rim cylinder operation and inside turn piece activation. Mounting applications for aluminum, glass, steel and wood doors, with customized sizing and configuration options. Locking pulls shall be provided with a 10" clearance from the finished floor on the cylinder side to accommodate wheelchair accessibility.
 1. Manufacturers:
 - a. Blumcraft (BL) - Locking Ladder Series.
 - b. Dorma Products (DO) - Locking Ladder Series.
 - c. Rockwood (RO) - LP Series.

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
 - 1. Manufacturers:
 - a. Match Existing, Field Verify.
- B. 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: Match Facility Standard.
- C. 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. Existing System: Field verify and key cylinders to match Owner's existing system.
- D. 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).
- E. Construction Keying: Provide construction master keyed cylinders.
- F. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

- A. Key Control Software: Provide software that offers solutions for master key system design and management, key, key ring, and item issuance, cylinder and core pinning, personal records and inventories and building, door, and floor plans. Software shall come with the option for

additional services that provide custom data integration, on-site and virtual training, consulting, technical support, and custom development.

1. Key Control: System shall manage all master key systems, keys, key rings, key holders and key requests. It shall provide total key control showing outstanding keys, overdue keys (with automatic notifications), key symbols, bittings, keyways, etc. and the ability to include all systems (multiple key manufacturers supported) and buildings in one database.
2. Master Keying: Software shall provide a comprehensive master key system generator compatible with multiplex systems (key sections, keyways, angles) along with a core pinning calculator. Master keying feature shall have automatic configurable key numbering and connection with key cutting machines.
3. Facility Management: Software shall reference every building, floor, and door of your facilities while identifying the operating keys of every door and generate control reports.
4. Available options shall include.
 - a. Web Interface: Web portal option for key requests and approvals. Web users shall have restricted access, according to their privileges.
 - b. Mobile Application for Key Deliveries: Display the list of keys issued, key policy, and capture the signature in the field.
5. Manufacturers:
 - a. Medeco (MC) - Simple K.

2.7 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
 1. Heavy duty mortise locks shall have a ten-year warranty.
 2. Where specified, provide status indicators with highly reflective color and wording for “locked/unlocked” or “vacant/occupied” with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1” x 0.6” with a curved design allowing a 180-degree viewing angle with protective covering to prevent tampering.
 3. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML2000 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
 - c. Schlage (SC) - L9000 Series.

- B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.
1. Locks shall meet or exceed the requirements of ANSI/BHMA A156.2 Series 4000, Grade 1 with all standard trims, as follows:
 - a. Cycle Test: ANSI/BHMA A156.2 Grade 1 requirements with no lever sag.
 - b. Abusive Locked Lever Torque: Exceed 3,100 in-lb with no entry; lock to maintain egress functionality in compliance with BHMA certification requirements.
 - c. Offset Lever Pull: Exceed 1,600 lbs with no entry (8 times ANSI/BHMA A156.2 requirements).
 - d. Latch Retraction with Preload: Exceed 100 lb preload while maintaining ANSI/BHMA requirements for operation in warped doors (2 times ANSI/BHMA A156.2 requirements).
 2. Heavy duty cylindrical locks shall have a seven-year warranty.
 3. Vertical Impact: Exceed 100 vertical impacts (20 times ANSI/BHMA A156.2 requirements).
 4. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
 5. Locks are to be non-handed and fully field reversible.
 6. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - CLX3300 Series.
 - b. Sargent Manufacturing (SA) - 10X Line.
 - c. Schlage (SC) - ND Series.

2.8 ELECTROMECHANICAL LOCKING DEVICES

- A. Electromechanical Cylindrical Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical cylindrical locksets, electrified locksets to be of type and design as specified below.
1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control and request-to-exit signaling. Unless otherwise indicated, provide electrified locksets standard as fail secure.
 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - CL33900 Series.
 - b. Sargent Manufacturing (SA) - 10G70/71 Series.
 - c. Schlage (SC) - ND DEL/DEU Series.

2.9 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. 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.

2.10 ELECTRIC STRIKES

- A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.
1. Manufacturers:
 - a. Folger Adam (FO) - 742 Series.
 - b. HES (HS) - 1500/1600 Series.
 - c. Von Duprin (VD) - 6200/6400 Series.
- B. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.
1. Manufacturers:

- a. Adams Rite (AD) - 7800 Series.
- b. HES (HS) - 9400/9500/9600/9700/9800 Series.
- c. Von Duprin (VD) - VD3146/6200/6300 Series.

- C. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.11 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. 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.
3. 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.
4. 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.
5. 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.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets.
1. Exit devices shall have no catch points.
 2. Exit devices shall have no visible plastic.
 3. Exit devices shall have concealed hex key dogging.
 4. Exit devices shall have narrow or wide style exterior trim as specified in the hardware sets.
 5. Concealed vertical rod exit devices shall have center case adjustability.
 6. Exit devices shall not require wire routing through the door for electromechanical functions.
7. Manufacturers:
- a. Corbin Russwin Hardware (RU) - PED4000 / PED5000 Series.
 - b. Sargent Manufacturing (SA) - PE80 Series.
 - c. Von Duprin (VD) - 35A/98 XP Series.

2.12 ELECTROMECHANICAL EXIT DEVICES

- A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.
1. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.
 2. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.
3. Manufacturers:
- a. Corbin Russwin Hardware (RU) - ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Von Duprin (VD) - 35A/98 XP Series.

2.13 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 (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Heavy duty surface mounted door closers shall have a 30-year warranty.
 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.
 - b. LCN Closers (LC) - 4040 Series.
 - c. Sargent Manufacturing (SA) - 351 Series.
- C. Door Closers, Surface Mounted (Commercial 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) - DC6000 Series.
 - b. Norton Rixson (NO) - 8500 Series.
 - c. Sargent Manufacturing (SA) - 1431 Series.

2.14 SURFACE MOUNTED CLOSER HOLDERS

- A. Electromagnetic Door Holders: ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate 12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.
1. Manufacturers:
 - a. LCN Door Closers (LC) - SEM7800 Series.
 - b. Norton Rixson (RF) - 980/990 Series.
 - c. Sargent Manufacturing (SA) - 1560 Series.

2.15 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 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. Burns Manufacturing (BU).
 - b. Ives (IV).
 - c. Rockwood (RO).

2.16 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 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. Burns Manufacturing (BU).
 - b. Ives (IV).
 - c. Rockwood (RO).

- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 - 1. Manufacturers:
 - a. Norton Rixson (RF).
 - b. Rockwood (RO).
 - c. Sargent Manufacturing (SA).

2.17 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).

2.18 ELECTRONIC ACCESSORIES

- A. Request-to-Exit Motion Sensor: Request-to-Exit Sensors motion detectors specifically designed for detecting exiting through a door from the secure area to a non-secure area. Include built-in timers (up to 60 second adjustable timing), door monitor with sounder alert, internal vertical pointability coverage, 12VDC or 24VDC power and selectable relay trigger with fail safe/fail secure modes.
 - 1. Manufacturers:
 - a. Alarm Controls (AK) - SREX Series.
 - b. Securitron (SU) - XMS Series.
- B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
 - 1. Manufacturers:
 - a. Sargent Manufacturing (SA) - 3280 Series.
 - b. Securitron (SU) - DPS Series.
- C. Wiegand Test Unit: Test unit verifies proper Wiegand output integrated card reader lock installation in the field by testing for proper wiring, card reader data integrity, and lock functionality including lock/unlock, door position, and request-to-exit status. 12 or 24VDC voltage adjustable operating as Fail Safe or Fail Secure.
 - 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - WT2 Wiegand Test Unit.
 - b. Sargent Manufacturing (SA) - WT2 Wiegand Test Unit.
- D. Switching Power Supplies: Provide power supplies with either single or dual voltage configurations at 12 or 24VDC. Power supplies shall have battery backup function with an integrated battery charging circuit and shall provide capability for power distribution, direct lock control and Fire Alarm Interface (FAI) through add on modules. Power supplies shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs.

1. Manufacturers:

- a. Securitron (SU) - AQD Series.

2.19 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.

2.20 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. Power Operator products and accessories are required to be installed through current members of the manufacturer's "Power Operator Preferred Installer" program.
- D. 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.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.6 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

- 1. Quantities listed are for each pair of doors, or for each single door.
- 2. The supplier is responsible for handing and sizing all products.
- 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
- 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

- B. Manufacturer's Abbreviations:

- 1. MK - McKinney
- 2. PE - Pemko
- 3. RO - Rockwood
- 4. SA - SARGENT
- 5. SC - Schlage
- 6. HS - HES

- 7. RF - Rixson
- 8. NO - Norton
- 9. OT - Other
- 10. MC - Medeco
- 11. SU - Securitron

Hardware Sets

Set: 1.0

Doors: L163B, L164B, L165C

2 Continuous Hinge	CFM_SLF-HD1 PT x Length Required		PE	087100
1 Narrow CVR Exit Device (STRM, RX, ELR, CD)	LC 16 55 56 ADPE8406 NEL (Cyl. Dogging)	US32D	SA	087100
1 Narrow CVR Exit Device (EO, RX, CD)	16 55 ADPE8410 EO (Cyl. Dogging)	US32D	SA	087100
3 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
2 Surface Closer	351 CPS (HD Cush STP Arm)	EN	SA	087100
2 Drop Plate	351D (as required)	EN	SA	087100
2 Blade Stop Spacer Kit	581-1 or 2 (as required)	EN	SA	087100
1 Threshold	273x224AFGT MSES25SS x Length Required		PE	087100
1 Gasketing	Provided By Door/Frame Supplier		OT	
2 Sweep	3452CNB x Length Required		PE	087100
1 Card Reader	By Security Supplier			
2 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
2 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
2 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	
2 Electric Power Transfer	EL-CEPT	630	SU	087100

Notes: Perimeter and meeting stile gasket by door / frame manufacturer.

System Operational Narrative:

- Doors are normally closed and latched.

- Active leaf Exit Device has Nightlatch Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will retract the exit device latch at the active leaf to allow authorized entry before relocking.
- Manual egress is always available by pressing either exit device push bar of the pair. Request to exit switches in the exit device push bars will signal an authorized egress to that access control system.
- The exit devices are fail secure and will remain latched in the absence of power.
- Door position switches at each leaf will signal the doors OPEN/CLOSED status to the access control panel.

Set: 2.0

Doors: L174A

2 Continuous Hinge	CFM_SLF-HD1 PT x Length Required		PE	087100
1 Narrow CVR Exit Device (NL, RX, ELR, CD)	LC 16 55 56 ADPE8410 P106 (Cyl. Dogging)	US32D	SA	087100
1 Narrow CVR Exit Device (EO, RX, ELR, CD)	16 55 56 ADPE8410 EO (Cyl. Dogging)	US32D	SA	087100
3 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
2 Offset Pull	RM2330-24 HD Through-Bolt Mount	US32D	RO	087100
2 Automatic Opener	6310 / 6330 (As Required)	689	NO	087113
1 Threshold	273x224AFGT MSES25SS x Length Required		PE	087100
1 Gasketing	Provided By Door/Frame Supplier		OT	
2 Sweep	3452CNB x Length Required		PE	087100
1 Card Reader	By Security Supplier			
2 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
2 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
2 Bollard Post w/Actuator Switch	500	689	NO	087100
2 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	
2 Electric Power Transfer	EL-CEPT	630	SU	087100

Notes: Perimeter and meeting stile gasket by door / frame manufacturer.

System Operational Narrative:

During Normal Hours of Operation:

- Exit Device Latches are electronically held (Dogged) to allow Push Pull Operation. (Time is set via the

access control system)

- When the actuator button on either side of the opening is pressed the auto operator will open both doors of the pair for assisted entry or egress.
- Manual entry or egress is always available by pushing exit device push bar or pulling door open.
- Door position switches at each leaf will signal the doors OPEN/CLOSED status to the access control panel.
- The exit devices are fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

After Normal Hours of operation:

- Doors are normally closed and latched.
- Active leaf Exit Device has Nightlatch Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the door the access control system will momentarily retract the exit device latch at the active leaf and activates the auto operator actuator button on the secured side of the opening.
- When the actuator button on the secure is pressed (after the authorized card read) the auto operator will open the active leaf door of the pair.
- Egress can be achieved at any time by pushing the actuator button on the unsecured side of the opening to retract the exit device latch on the active leaf and activating the auto operator at the active leaf to open the door.
- Manual egress is always available by pressing either exit device push bar of the pair. Request to Exit Switches integrated in the exit device push bars will signal an authorized egress to the access control system.
- Door position switches at each leaf will signal the doors OPEN/CLOSED status to the access control panel.
- The exit devices are fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

Set: 3.0

Doors: L101A

2 Continuous Hinge	CFM_SLF-HD1 PT x Length Required		PE	087100
1 Narrow CVR Exit Device (NL, RX, ELR, CD)	LC 16 55 56 ADPE8410 P106 (Cyl. Dogging)	US32D	SA	087100
1 Narrow CVR Exit Device (EO, RX, ELR, CD)	16 55 56 ADPE8410 EO (Cyl. Dogging)	US32D	SA	087100
3 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
2 Offset Pull	RM2330-24 HD Through-Bolt Mount	US32D	RO	087100
2 Automatic Opener	6310 / 6330 (As Required)	689	NO	087113
1 Threshold	273x224AFGT MSES25SS x Length Required		PE	087100
1 Gasketing	Provided By Door/Frame Supplier		OT	

2 Sweep	3452CNB x Length Required		PE	087100
1 Card Reader	By Security Supplier			
2 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
2 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Bollard Post w/Actuator Switch	500	689	NO	087100
2 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Auto Operator Actuator Switch	505		NO	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	
2 Electric Power Transfer	EL-CEPT	630	SU	087100

Notes: Perimeter and meeting stile gasket by door / frame manufacturer.

System Operational Narrative:

During Normal Hours of Operation:

- Exit Device Latches are electronically held (Dogged) to allow Push Pull Operation. (Time is set via the access control system)
- When the actuator button on either side of the opening is pressed the auto operator will open both doors of the pair for assisted entry or egress.
- Manual entry or egress is always available by pushing exit device push bar or pulling door open.
- Door position switches at each leaf will signal the doors OPEN/CLOSED status to the access control panel.
- The exit devices are fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

After Normal Hours of operation:

- Doors are normally closed and latched.
- Active leaf Exit Device has Nightlatch Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the door the access control system will momentarily retract the exit device latch at the active leaf and activates the auto operator actuator button on the secured side of the opening.
- When the actuator button on the secure is pressed (after the authorized card read) the auto operator will open the active leaf door of the pair.
- Egress can be achieved at any time by pushing the actuator button on the unsecured side of the opening to retract the exit device latch on the active leaf and activating the auto operator at the active leaf to open the door.
- Manual egress is always available by pressing either exit device push bar of the pair. Request to Exit Switches integrated in the exit device push bars will signal an authorized egress to the access control system.
- Door position switches at each leaf will signal the doors OPEN/CLOSED status to the access control panel.
- The exit devices are fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

Set: 4.0

Doors: J101, L118A

1 Continuous Hinge	CFM_SLF-HD1 PT x Length Required		PE	087100
1 Narrow Rim Exit Device (NL, RX, ELR, CD)	LC 16 55 56 PE8504 Less Pull (Cyl. Dogging)	US32D	SA	087100
1 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
1 Offset Pull	RM2330-24 HD Through-Bolt Mount	US32D	RO	087100
1 Surface Closer	351 CPS (HD Cush STP Arm)	EN	SA	087100
1 Drop Plate	351D (as required)	EN	SA	087100
1 Blade Stop Spacer Kit	581-1 or 2 (as required)	EN	SA	087100
1 Threshold	273x224AFGT MSES25SS x Length Required		PE	087100
1 Gasketing	Provided By Door/Frame Supplier		OT	
1 Sweep	3452CNB x Length Required		PE	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	
1 Electric Power Transfer	EL-CEPT	630	SU	087100

Notes: Weatherstrip by Aluminum Door Manufacturer.

System Operational Narrative:

- Doors are normally closed and latched.
- Exit Device has Nightlatch Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will retract the exit device latch to allow authorized entry before relocking.
- Manual egress is always available by pressing the exit device push bar. Request to exit switch in the exit device push bars will signal an authorized egress to that access control system.
- The exit device is fail secure and will remain latched in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 5.0

Doors: L159B

1 Continuous Hinge	CFM_SLF-HD1 PT x Length Required		PE	087100
1 Narrow Rim Exit Device (NL, RX, ELR, CD)	LC 16 55 56 PE8504 Less Pull (Cyl. Dogging)	US32D	SA	087100
1 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
1 Surface Closer	351 CPS (HD Cush STP Arm)	EN	SA	087100
1 Drop Plate	351D (as required)	EN	SA	087100
1 Blade Stop Spacer Kit	581-1 or 2 (as required)	EN	SA	087100
1 Threshold	273x224AFGT MSES25SS x Length Required		PE	087100
1 Gasketing	Provided By Door/Frame Supplier		OT	
1 Sweep	3452CNB x Length Required		PE	087100
1 Harness Adaptor	52-2946		SA	
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	
1 Electric Power Transfer	EL-CEPT	630	SU	087100

Notes: Weatherstrip by Aluminum Door Manufacturer.

System Operational Narrative:

During Normal Hours of Operation:

- Exit Device Latch is electronically held (Dogged) to allow Push Pull Operation. (Time is set via the access control system)
- Manual entry or egress is always available by pushing exit device push bar or pulling door open.
- Door position switches at each leaf will signal the doors OPEN/CLOSED status to the access control panel.
- The exit device is fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

After Normal Hours of operation:

- Doors are normally closed and latched.
- Exit Device has Nightlatch Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will retract the exit device latch to allow authorized entry before relocking.
- Manual egress is always available by pressing the exit device push bar. Request to exit switch in the exit device push bars will signal an authorized egress to that access control system.
- The exit device is fail secure and will remain latched in the absence of power.

- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 6.0

Doors: C101A

1 Continuous Hinge	CFM_SLF-HD1 PT x Length Required		PE	087100
1 Narrow Rim Exit Device (NL, RX, ELR, CD)	LC 16 55 56 PE8504 Less Pull (Cyl. Dogging)	US32D	SA	087100
2 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
1 Offset Pull	RM2330-24 HD Through-Bolt Mount	US32D	RO	087100
1 Automatic Opener	6310 / 6330 (As Required)	689	NO	087113
1 Threshold	273x224AFGT MSES25SS x Length Required		PE	087100
1 Gasketing	Provided By Door/Frame Supplier		OT	
1 Sweep	3452CNB x Length Required		PE	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Bollard Post w/Actuator Switch	500	689	NO	087100
1 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Auto Operator Actuator Switch	505		NO	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	
1 Electric Power Transfer	EL-CEPT	630	SU	087100

Notes: Weatherstrip by Aluminum Door Manufacturer.

System Operational Narrative:

During Normal Hours of Operation:

- Exit Device Latch is electronically held (Dogged) to allow Push Pull Operation. (Time is set via the access control system)
- When the actuator button on either side of the opening is pressed the auto operator will open the door for entry or egress.
- Manual entry or egress is always available by pushing exit device push bar or pulling door open.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.
- The exit device is fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

After Normal Hours of operation:

- Door is normally closed and latched.
- Exit Device has Nightlatch Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the door the access control system will momentarily retract the exit device latch and activates the auto operator actuator button on the secured side of the opening.
- When the actuator button on the secure is pressed (after the authorized card read) the auto operator will open the door.
- Egress can be achieved at any time by pushing the actuator button on the unsecured side of the opening to retract the exit device latch and activating the auto operator to open the door.
- Manual egress is always available by pressing the exit device push bar. Request to Exit Switch integrated in the exit device push bar will signal an authorized egress to the access control system.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.
- The exit device is fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency.

Set: 7.0

Doors: [L179B](#)

4 Hinge, Full Mortise, Hvy Wt	T4A3386 (NRP and size as required)	US32D	MK	087100
2 Hinge, Full Mortised, Hvy Wt (PWR TRNS)	T4A3386-QCx (# of Wires and Size as Required)	US32D	MK	087100
1 CVR Exit Device (STRM, RX, ELR, CD)	LC 16 55 56 MDPE8606 WEL (Cyl. Dogging)	US32Dq	SA	087100
1 CVR Exit Device (EO, RX, CD)	LC 16 55 MDPE8610 EO (Cyl. Dogging)	US32D	SA	087100
3 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
2 Surface Closer	351 CPS (HD Cush STP Arm)	EN	SA	087100
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Threshold	273x224AFGT MSES25SS x Length Required		PE	087100
1 Gasketing	303AS (Head & Jambs)		PE	087100
1 Rain Guard	346C x Width of Frame Head		PE	087100
2 Sweep	3452CNB x Length Required		PE	087100
1 Astragal	29324CNB x Door Height		PE	087100
1 Card Reader	By Security Supplier			
2 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
2 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
2 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
2 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Doors are normally closed and latched.
- Active leaf Exit Device has Nightlatch Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the door the access control system will momentarily retract the exit device latch at the active leaf to allow authorized entry.
- Manual egress is always available by pressing either exit device push bar of the pair. Request to Exit Switches integrated in the exit device push bars will signal an authorized egress to the access control system.
- Door position switches at each leaf will signal the doors OPEN/CLOSED status to the access control panel.
- The exit devices are fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency.

Set: 8.0

Doors: 101A

2 Hinge, Full Mortise, Hvy Wt	T4A3386 (NRP and size as required)	US32D	MK	087100
1 Hinge, Full Mortised, Hvy Wt (PWR TRNS)	T4A3386-QCx (# of Wires and Size as Required)	US32D	MK	087100
1 Rim Exit Device (STRM, EL Trim-Fail Sec., RX, Less Dogging)	LC LD WR 53 55 PE8876-24v WEL	US32D	SA	087400
1 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
1 Surface Closer	351 CPS (HD Cush STP Arm)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Threshold	273x224AFGT MSES25SS x Length Required		PE	087100
1 Gasketing	303AS (Head & Jambs)		PE	087100
1 Rain Guard	346C x Width of Frame Head		PE	087100
1 Sweep	3452CNB x Length Required		PE	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Door is normally closed and latched.

- Exit Device has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the exit trim lever to allow authorized entry before relocking.
- Manual egress is always available by pressing the exit device push bar. Request to exit switch in the exit device push bars will signal an authorized egress to that access control system.
- The exit device trim is fail secure and will remain locked, and the exit device latched in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 9.0

Doors: L174B

2 Continuous Hinge	CFM_SLF-HD1 PT x Length Required		PE	087100
1 Narrow CVR Exit Device (NL, RX, ELR, CD)	LC 16 55 56 ADPE8410 P106 (Cyl. Dogging)	US32D	SA	087100
1 Narrow CVR Exit Device (EO, RX, ELR, CD)	16 55 56 ADPE8410 EO (Cyl. Dogging)	US32D	SA	087100
3 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
2 Offset Pull	RM2330-24 HD Through-Bolt Mount	US32D	RO	087100
2 Automatic Opener	6310 / 6330 (As Required)	689	NO	087113
1 Gasketing	Provided By Door/Frame Supplier		OT	
1 Card Reader	By Security Supplier			
2 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
2 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
2 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
2 Auto Operator Actuator Switch	505		NO	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	
2 Electric Power Transfer	EL-CEPT	630	SU	087100

Notes: Perimeter and meeting stile gasket by door / frame manufacturer.

System Operational Narrative:

During Normal Hours of Operation:

- Exit Device Latches are electronically held (Dogged) to allow Push Pull Operation. (Time is set via the access control system)
- When the actuator button on either side of the opening is pressed the auto operator will open both doors of the pair for assisted entry or egress.
- Manual entry or egress is always available by pushing exit device push bar or pulling door open.

- Door position switches at each leaf will signal the doors OPEN/CLOSED status to the access control panel.
- The exit devices are fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

After Normal Hours of operation:

- Doors are normally closed and latched.
- Active leaf Exit Device has Nightlatch Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the door the access control system will momentarily retract the exit device latch at the active leaf and activates the auto operator actuator button on the secured side of the opening.
- When the actuator button on the secure is pressed (after the authorized card read) the auto operator will open the active leaf door of the pair.
- Egress can be achieved at any time by pushing the actuator button on the unsecured side of the opening to retract the exit device latch on the active leaf and activating the auto operator at the active leaf to open the door.
- Manual egress is always available by pressing either exit device push bar of the pair. Request to Exit Switches integrated in the exit device push bars will signal an authorized egress to the access control system.
- Door position switches at each leaf will signal the doors OPEN/CLOSED status to the access control panel.
- The exit devices are fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

Set: 10.0

Doors: L174C

1 Continuous Hinge	CFM_SLF-HD1 PT x Length Required		PE	087100
1 Narrow Rim Exit Device (NL, RX, ELR, CD)	LC 16 55 56 PE8504 Less Pull (Cyl. Dogging)	US32D	SA	087100
2 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
1 Offset Pull	RM2330-24 HD Through-Bolt Mount	US32D	RO	087100
1 Automatic Opener	6310 / 6330 (As Required)	689	NO	087113
1 Gasketing	Provided By Door/Frame Supplier		OT	
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
2 Auto Operator Actuator Switch	505		NO	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as		OT	

	Specified			
1 Electric Power Transfer	EL-CEPT	630	SU	087100

Notes: Weatherstrip by Aluminum Door Manufacturer.

System Operational Narrative:

During Normal Hours of Operation:

- Exit Device Latch is electronically held (Dogged) to allow Push Pull Operation. (Time is set via the access control system)
- When the actuator button on either side of the opening is pressed the auto operator will open the door for entry or egress.
- Manual entry or egress is always available by pushing exit device push bar or pulling door open.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.
- The exit device is fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

After Normal Hours of operation:

- Door is normally closed and latched.
- Exit Device has Nightlatch Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the door the access control system will momentarily retract the exit device latch and activates the auto operator actuator button on the secured side of the opening.
- When the actuator button on the secure is pressed (after the authorized card read) the auto operator will open the door.
- Egress can be achieve at any time by pushing the actuator button on the unsecured side of the opening to retract the exit device latch and activating the auto operator to open the door.
- Manual egress is always available by pressing the exit device push bar. Request to Exit Switch integrated in the exit device push bar will signal an authorized egress to the access control system.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.
- The exit device is fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency.

Set: 11.0

Doors: L101B

2 Continuous Hinge	CFM_SLF-HD1 x Length Required		PE	087100
2 Offset Pull	RM2330-24 HD Through-Bolt Mount	US32D	RO	087100
2 Push Bar	RM2312 HD Back-to-Back Mount with Pull	US32	RO	087100
2 Automatic Opener	6310 / 6330 (As Required)	689	NO	087113
1 Gasketing	Provided By Door/Frame Supplier		OT	
2 Auto Operator Actuator Switch	505		NO	087100

Notes: Perimeter and meeting stile gasket by door / frame manufacturer.

Operation:

- Doors are normally closed. Push / Pull Function - No Latching.
- When the Auto operator actuator button on either side of the opening is pressed the auto operators will open both doors of the pair for assisted egress or entry.

Set: 12.0

Doors: L101C

2 Continuous Hinge	CFM_SLF-HD1 x Length Required	PE	087100
2 Offset Pull	RM2330-24 HD Through-Bolt Mount	US32D	RO 087100
2 Push Bar	RM2312 HD Back-to-Back Mount with Pull	US32	RO 087100
2 Automatic Opener	6310 / 6330 (As Required)	689	NO 087113
1 Gasketing	Provided By Door/Frame Supplier		OT
1 Bollard Post w/Actuator Switch	500	689	NO 087100
1 Auto Operator Actuator Switch	505		NO 087100

Notes: Perimeter and meeting stile gasket by door / frame manufacturer.

Operation:

- Doors are normally closed. Push / Pull Function - No Latching.
- When the Auto operator actuator button on either side of the opening is pressed the auto operators will open both doors of the pair for assisted egress or entry.

Set: 13.0

Doors: L118B

1 Continuous Hinge	CFM_SLF-HD1 x Length Required	PE	087100
1 Offset Pull	RM2330-24 HD Through-Bolt Mount	US32D	RO 087100
1 Push Bar	RM2312 HD Back-to-Back Mount with Pull	US32	RO 087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA 087100
1 Drop Plate	351D (as required)	EN	SA 087100
1 Blade Stop Spacer Kit	581-1 or 2 (as required)	EN	SA 087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100
1 Gasketing	Provided By Door/Frame Supplier		OT

Notes: Perimeter Weatherstrip and astragals by the Aluminum Door Manufacturer.

Set: 14.0

Doors: C101B

1 Continuous Hinge	CFM_SLF-HD1 x Length Required	PE	087100
1 Offset Pull	RM2330-24 HD Through-Bolt Mount	US32D	RO 087100
1 Push Bar	RM2312 HD Back-to-Back Mount with Pull	US32	RO 087100
1 Automatic Opener	6310 / 6330 (As Required)	689	NO 087113
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100
1 Gasketing	Provided By Door/Frame Supplier	OT	
1 Narrow Auto Operator Actuator Switch	503	NO	087100
1 Auto Operator Actuator Switch	505	NO	087100

Notes: Perimeter Weatherstrip and astragals by the Aluminum Door Manufacturer.

Operation:

- Door is normally closed. Push / Pull Function - No Latching.
- When the Auto operator actuator button on either side of the opening is pressed the auto operator will open the door for assisted egress or entry.

Set: 15.0

Doors: L115, L173

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK 087100
1 Rim Exit Device (STRM, Less Dogging)	LC LD PE8804 WEL	US32D	SA 087100
1 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC 087100
1 ElectroLynx Adaptor	2004M	HS	087100
1 SMART Pac Bridge Rectifier	2005M3	HS	087100
1 Electric Strike	9000 Series - Type as Required for Exit Latch	630	HS 087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA 087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO 087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100
3 Silencer	608	RO	087100
1 Card Reader	By Security Supplier		
1 ElectroLynx Harness (Frame)	QC-C3000P	MK	087100
1 Motion Sensor	XMS	SU	087100
1 Position Switch	DPS-MW-BK/GY/WH (as required)	SU	087100

1 Power Supply	AQD (Size and Options as required)	SU 087100
1 Wiring Diagram	Elevation and Point to Point as Specified	OT

Notes: L115 Opens to 180 Degrees.

System Operational Narrative:

- Door is normally closed and latched.
- Exit Device has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by pressing the exit device push bar. Request to exit motion sensor will signal an authorized egress to that access control system.
- The electric strike is fail secure and will remain fixed/locked, holding the exit device latched in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Notes: System Operational Narrative:

When Required (as Programmed through the access control system):

- The electric strike is electronically released and held in the released condition to allow Push/Pull operation.
- Manual entry and egress is always available by pressing the exit device push bar.
- The electric strike is fail secure and will engage the latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

Set: 16.0

Doors: 103A, 103B, Z309A

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Fire Rated Rim Exit Device (STRM)	LC 12 PE8804 WEL	US32D	SA	087100
1 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
1 Electric Strike	9000 Series (Fire rated) Type as required for exit latch	630	HS	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Motion Sensor	XMS		SU	087100

1 Position Switch	DPS-MW-BK/GY/WH (as required)	SU	087100
1 Power Supply	AQD (Size and Options as required)	SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified	OT	

Notes: System Operational Narrative:

- Door is normally closed and latched.
- Exit Device has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by pressing the exit device push bar. Request to exit motion sensor will signal an authorized egress to that access control system.
- The electric strike is fail secure and will remain fixed/locked, holding the exit device latched in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 16.1

Doors: 102

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Fire Rated Rim Exit Device (STRM)	LC 12 PE8804 WEL	US32D	SA	087100
1 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
1 Electric Strike	9000 Series (Fire rated) Type as required for exit latch	630	HS	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Motion Sensor	XMS		SU	087100
1 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

When Required (as Programmed through the access control system):

- The electric strike is electronically released and held in the released condition to allow Push/Pull operation.
- Manual entry and egress is always available by pressing the exit device push bar.
- The electric strike is fail secure and will engage the latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

When the electric Strike is not held:

- Door is normally closed and latched.
- Exit Device has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by pressing the exit device push bar. Request to exit motion sensor will signal an authorized egress to that access control system.
- The electric strike is fail secure and will remain fixed/locked, holding the exit device latched in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 17.0

Doors: [L194](#)

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Fire Rated Rim Exit Device (STRM)	LC 12 PE8804 WEL	US32D	SA	087100
1 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
1 Electric Strike	9000 Series (Fire rated) Type as required for exit latch	630	HS	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Automatic Opener	6310 / 6330 (As Required)	689	NO	087113
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Motion Sensor	XMS		SU	087100
1 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
2 Auto Operator Actuator Switch	505		NO	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

When Required (as Programmed through the access control system):

- The electric strike is electronically released and held in the released condition to allow Push/Pull operation.
- When the actuator button on either side of the opening is pressed the auto operator will open the door for entry or egress.
- Manual entry or egress is always available by pushing exit device push bar or pulling door open.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.
- The electric strike is fail secure and will engage the latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

When the electric Strike is not held:

- Door is normally closed and latched.
- Exit Device has Nightlatch Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the door the access control system will momentarily release the electric strike and activates the auto operator actuator button on the secured side of the opening.
- When the actuator button on the secure is pressed (after the authorized card read) the auto operator will open the door.
- Egress can be achieve at any time by pushing the actuator button on the unsecured side of the opening to release the electric strike and activating the auto operator to open the door.
- Manual egress is always available by pressing the exit device push bar. Request to Exit motion sensor will signal an authorized egress to the access control system.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.
- The electric strike is fail secure and will engage the latch upon activation of fire alarm or in the absence of power. Key override cylinder for emergency.

Set: 18.0

Doors: L163A, L164A, L165A

4 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
2 Hinge, Full Mortise, Hvy Wt (PWR TRNS)	T4A3786 QCx (# of Wires and Size as Required)	US26D	MK	087100
2 SVR Exit Device (CLRM, RX, ELR, LBR, CD)	LC 16 55 56 NBPE8713 WEL	US32D	SA	087100
4 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC	087100
2 Surface Closer	351 CPSH (HD PA SPG STP Arm w/HO)	EN	SA	087100
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
2 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
2 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			

2 ElectroLynx Harness (Door)	QC-C**** x Length Required	MK 087100
2 ElectroLynx Harness (Frame)	QC-C3000P	MK 087100
2 Position Switch	DPS-MW-BK/GY/WH (as required)	SU 087100
1 Power Supply	AQD (Size and Options as required)	SU 087100
1 Wiring Diagram	Elevation and Point to Point as Specified	OT

Notes: System Operational Narrative:

- Exit Device Trim is Classroom function, Exit Trim can be locked or unlocked as required When Required (as Programmed through the access control system):
 Exit Device Trim is in the locked condition:
- Exit Device Latches are electronically held (Dogged) to allow Push Pull Operation. (Time is set via the access control system)
- Manual entry or egress is always available by pushing exit device push bar or pulling door open.
- Door position switches at each leaf will signal the doors OPEN/CLOSED status to the access control panel.
- The exit devices are fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

Exit Device Latches are NOT electronically Held:

- Doors are normally closed and latched. Exit Device Trim is in the locked condition
- Active leaf Exit Device has Nightlatch Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the door the access control system will momentarily retract the exit device latch at the active leaf to allow authorized entry before relocking.
- Manual egress is always available by pressing either exit device push bar of the pair. Request to Exit Switches integrated in the exit device push bars will signal an authorized egress to the access control system.
- Door position switches at each leaf will signal the doors OPEN/CLOSED status to the access control panel.
- The exit devices are fail secure and will latch on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

Set: 19.0

Doors: Z308

2 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK 087100
1 Hinge, Full Mortise, Hvy Wt (PWR TRNS)	T4A3786 QCx (# of Wires and Size as Required)	US26D	MK 087100
1 Fire Rated Rim Exit Device (STRM, EL Trim-Fail Safe, RX)	LC 12 53 55 PE8875-24v WEL	US32D	SA 087400
1 Cylinder (Type as Required)	Rim or Mortised Cylinder as Required (Keyed to the owner's existing key system)	.630	SC 087100

1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Door is normally closed and latched.
- Exit Device has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the exit trim lever to allow authorized entry before relocking.
- Manual egress is always available by pressing the exit device push bar. Request to exit switch in the exit device push bars will signal an authorized egress to that access control system.
- The exit exit trim lever will become unlocked, (Fail Safe), but exit device will remain latched in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 20.0

Doors: 101B, 264, L159A, Z309B

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Fire rated Rim Exit Device (PASS)	12 PE8815 WEL	US32D	SA	087100
1 Surface Closer	351 CPS (HD Cush STP Arm)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100

Set: 21.0

Doors: D106

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Storeroom/Closet Lock	10XG04 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100

1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Motion Sensor	XMS		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Door is normally closed and latched. (No Closer, Door must be manually closed to be secured).
- Lockset has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Alternate Access by remote push button releasing the electric strike while depressed to allow authorized access and relocking when released.
- Manual egress is always available by turning the lockset lever on the unsecure side. Request to exit motion sensor will signal an authorized egress to that access control system.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 22.0

Doors: D110, D111, D113, D128, K103, L116, L155, L156, L171B, L192A, L195, L239

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Storeroom/Closet Lock	10XG04 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: D128, L156, L171B and L195 Open to 180 Degrees

System Operational Narrative:

- Door is normally closed and latched.
- Lockset has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by turning the lockset lever on the unsecure side.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.

Set: 22.1

Doors: L113, L187B, L189A, L190A, L242

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Storeroom/Closet Lock	10XG04 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Motion Sensor	XMS		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Door is normally closed and latched.
- Lockset has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by turning the lockset lever on the unsecure side. Request to exit motion sensor will signal an authorized egress to that access control system.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 23.0

Doors: L192B

2 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
2 Hinges, Spring	1502 (size as required)	US26D	MK	087100
1 Surface Bolt	630-8	US26D	RO	087100
1 Storeroom/Closet Lock	10XG04 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
2 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Motion Sensor	XMS		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Dutch Door. Top Door Bolts into Bottom Door with Surface Bolt mounted on the unsecure side. Shelf as required.

System Operational Narrative when both top and bottom are bolted together and closed:

- Door is normally closed and latched.
- Lockset has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by turning the lockset lever on the unsecure side. Request to exit motion sensor will signal an authorized egress to that access control system.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 24.0

Doors: D105, L193, L273

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Storeroom/Closet Lock	10XG04 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 ElectroLynx Adaptor	2004M		HS	087100

1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Motion Sensor	XMS		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Door is normally closed and latched.
- Lockset has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Alternate Access by remote push button releasing the electric strike while depressed to allow authorized access and relocking when released.
- Manual egress is always available by turning the lockset lever on the unsecure side. Request to exit motion sensor will signal an authorized egress to that access control system.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 25.0

Doors: C133

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Storeroom/Closet Lock	10XG04 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
3 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Door is normally closed and latched.
- Lockset has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by turning the lockset lever on the unsecure side.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.

Set: 26.0

Doors: [L125B](#)

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Storeroom/Closet Lock	10XG04 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
1 Surf Overhead Stop	10-X36 (Size as Required)	630	RF	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
3 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Motion Sensor	XMS		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: D128 Opens to 180 Degrees

System Operational Narrative:

- Door is normally closed and latched.
- Lockset has Storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by turning the lockset lever on the unsecure side. Request to exit motion sensor will signal an authorized egress to that access control system.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 27.0

Doors: [L124](#), [L245A](#), [L245B](#), [L246](#)

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Entry/Office Lock	10XG05 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Door is normally closed and latched.
- Lockset has Office Function (can be locked or unlocked with key or thumbturn as required).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by turning the lockset lever on the unsecure side.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.

Set: 28.0

Doors: [L154A](#), [L154B](#)

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Entry/Office Lock	10XG05 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
1 Surf Overhead Stop	10-X36 (Size as Required)	630	RF	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Motion Sensor	XMS		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as		OT	

Specified

Notes: System Operational Narrative:

- Door is normally closed and latched.
- Lockset has Office Function (can be locked or unlocked with key or thumbturn as required).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by turning the lockset lever on the unsecure side. Request to exit motion sensor will signal an authorized egress to that access control system.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 29.0

Doors: L120B, L121A, L211, L241

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Classroom Lock	10XG37 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Motion Sensor	XMS		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Door is normally closed and latched.
- Lockset has Classroom Function (Key will Lock or Unlock Lockset as Required).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by turning the lockset lever on the unsecure side. Request to exit motion sensor will signal an authorized egress to that access control system.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 29.1

Doors: L197A, L197B

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Classroom Lock	10XG37 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Door is normally closed and latched.
- Lockset has Classroom Function (Key will Lock or Unlock Lockset as Required).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by turning the lockset lever on the unsecure side.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.

Set: 30.0

Doors: C104, L104, L120A, L236

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Classroom Lock	10XG37 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 ElectroLynx Adaptor	2004M		HS	087100
1 SMART Pac Bridge Rectifier	2005M3		HS	087100
1 Electric Strike	1600-CLB	630	HS	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			

1 ElectroLynx Harness (Frame)	QC-C3000P	MK 087100
1 Power Supply	AQD (Size and Options as required)	SU 087100
1 Wiring Diagram	Elevation and Point to Point as Specified	OT

Notes: System Operational Narrative:

- Door is normally closed and latched.
- Lockset has Classroom Function (Key will Lock or Unlock Lockset as Required).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Alternate Access by remote push button releasing the electric strike while depressed to allow authorized access and relocking when released.
- Manual egress is always available by turning the lockset lever on the unsecure side.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.

Set: 31.0

Doors: L153A, L153B

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK 087100
1 Classroom Lock	10XG37 LL SC (Keyed to Owner's Existing Key system)	US26D	SA 087100
1 ElectroLynx Adaptor	2004M		HS 087100
1 SMART Pac Bridge Rectifier	2005M3		HS 087100
1 Electric Strike	1600-CLB	630	HS 087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100
1 Sound Gaskets	Sound Gasket to meet the required STC Rating by Door/Frame Manufacturer		OT
1 Card Reader	By Security Supplier		
1 ElectroLynx Harness (Frame)	QC-C3000P		MK 087100
1 Motion Sensor	XMS		SU 087100
1 Power Supply	AQD (Size and Options as required)		SU 087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT

Notes: System Operational Narrative:

- Door is normally closed and latched.
- Lockset has Classroom Function (Key will Lock or Unlock Lockset as Required).
- When an authorized card read is detected on the secured side of the opening the access control system will release the electric strike to allow authorized entry before relocking.
- Manual egress is always available by turning the lockset lever on the unsecure side. Request to exit motion sensor will signal an authorized egress to that access control system.
- The electric strike is fail secure and will remain fixed/locked in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 32.0

Doors: [L165B](#)

5 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Hinge, Full Mortise, Hvy Wt (PWR TRNS)	T4A3786 QCx (# of Wires and Size as Required)	US26D	MK	087100
1 Self Latching Flush Bolt Set	2845 / 2945 (as required)	US26D	RO	087100
1 Dust Proof Strike	570	US26D	RO	087100
1 Electrified Lock (Fail Sec., RX)	SC RX 28 10G71-24V LL (Keyed to Owner's Existing Key system)	US26D	SA	087100
2 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
2 Kick Down Door Holder	461	US26D	RO	087100
2 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
2 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
2 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Door open to 180 degrees. Kick Down HO

System Operational Narrative:

- Door normally closed and secure.
- Electrified Lockset has Storeroom Function (Key will retract latch to open door, door is locked when the key is removed).
- Access by valid credential presentation releasing the lockset lever for a pre-determined time limit and then relocking.
- Egress always free for immediate exit. Request-to-Exit sensor allows exit without alarm condition.
- Door position switch provides open/closed monitoring to both access control system and intrusion alarm service.
- Lockset Lever remains locked (fail secure) in event of power loss.

Set: 33.0

Doors: [L179A](#)

5 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
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1 Hinge, Full Mortise, Hvy Wt (PWR TRNS)	T4A3786 QCx (# of Wires and Size as Required)	US26D	MK	087100
1 Self Latching Flush Bolt Set	2845 / 2945 (as required)	US26D	RO	087100
1 Dust Proof Strike	570	US26D	RO	087100
1 Electrified Lock (Fail Sec., RX)	SC RX 28 10G71-24V LL (Keyed to Owner's Existing Key system)	US26D	SA	087100
2 Surf Overhead Stop	10-X36 (Size as Required)	630	RF	087100
2 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
2 Kick Down Door Holder	461	US26D	RO	087100
2 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Door normally closed and secure.
- Electrified Lockset has Storeroom Function (Key will retract latch to open door, door is locked when the key is removed).
- Access by valid credential presentation releasing the lockset lever for a pre-determined time limit and then relocking.
- Egress always free for immediate exit. Request-to-Exit sensor allows exit without alarm condition.
- Door position switch provides open/closed monitoring to both access control system and intrusion alarm service.
- Lockset Lever remains locked (fail secure) in event of power loss.

Set: 33.1

Doors: [L162](#)

5 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Hinge, Full Mortise, Hvy Wt (PWR TRNS)	T4A3786 QCx (# of Wires and Size as Required)	US26D	MK	087100
1 Self Latching Flush Bolt Set	2845 / 2945 (as required)	US26D	RO	087100
1 Dust Proof Strike	570	US26D	RO	087100
1 Electrified Lock (Fail Sec., RX)	SC RX 28 10G71-24V LL (Keyed to Owner's Existing Key system)	US26D	SA	087100

2 Surf Overhead Stop	10-X36 (Size as Required)	630	RF	087100
2 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100
1 Astragal	S772BL x Door Height		PE	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Position Switch	DPS-MW-BK/GY/WH (as required)		SU	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100
1 Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: System Operational Narrative:

- Door normally closed and secure.
- Electrified Lockset has Storeroom Function (Key will retract latch to open door, door is locked when the key is removed).
- Access by valid credential presentation releasing the lockset lever for a pre-determined time limit and then relocking.
- Egress always free for immediate exit. Request-to-Exit sensor allows exit without alarm condition.
- Door position switch provides open/closed monitoring to both access control system and intrusion alarm service.
- Lockset Lever remains locked (fail secure) in event of power loss.

Set: 34.0

Doors: [L160A](#)

2 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Hinge, Full Mortise, Hvy Wt (PWR TRNS)	T4A3786 QCx (# of Wires and Size as Required)	US26D	MK	087100
1 Electrified Lock (Fail Sec., RX)	SC RX 28 10G71-24V LL (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100
1 Card Reader	By Security Supplier			
1 ElectroLynx Harness (Door)	QC-C**** x Length Required		MK	087100
1 ElectroLynx Harness (Frame)	QC-C3000P		MK	087100
1 Power Supply	AQD (Size and Options as required)		SU	087100

1 Wiring Diagram	Elevation and Point to Point as Specified	OT
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Notes: System Operational Narrative:

During Normal Hours of Operation:

- The electrified lockset is charged, (unlocked) to allow free entry or egress. (Time is set via the access control system)
- Manual entry or egress is always available by turning the lockset lever on either side of the door to open.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.
- The electronic lock is fail secure and be locked on activation of fire alarm or in the absence of power. Key override cylinder for emergency access.

After Normal Hours of operation:

- Door is normally closed and latched.
- Lockset has storeroom Function (Key will retract the exit device latch, door is latched when the key is removed).
- When an authorized card read is detected on the secured side of the opening the access control system will release lockset lever to allow authorized entry before relocking.
- Manual egress is always available by turning the lockset lever on the unsecure side. Request to exit switch will signal an authorized egress to that access control system.
- The electronic lock is fail secure and will remain fixed/locked in the absence of power.
- Door position switch will signal the doors OPEN/CLOSED status to the access control panel.

Set: 35.0

Doors: [D103](#), [D114](#), [E103](#), [E104](#), [F101](#), [F102](#), [J102](#), [J103](#), [K101](#), [K102](#), [L117](#)

3 Existing	Reused Existing Hinges	OT
1 Existing	Reuse Existing Lockset	OT
1 Wall Stop	403 (or) 441CU (As Required)	US26D RO 087100
3 Silencer	608	RO 087100

Set: 36.0

NOT USED

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D MK 087100
1 Storeroom/Closet Lock	10XG04 LL SC (Keyed to Owner's Existing Key system)	US26D SA 087100
1 Surface Closer	351 CPS (HD Cush STP Arm)	EN SA 087100
1 Kick Plate	K1050 10" high CSK BEV	US32D RO 087100
3 Silencer	608	RO 087100

Set: 37.0

Doors: 104, C106

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Storeroom/Closet Lock	10XG04 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Gasketing	S88BL (Head & Jamb)		PE	087100

Notes: Doors 104 and C106 open to 180 Degrees

Set: 38.0

Doors: C118, D127, L106, L107, L108, L109, L110, L147, L148, L175, L176, L177, L187A, L188, L214, L215, L216, L217, L218, L219, L220, L221, L222, L223, L224, L225, L226, L227, L228, L230, L231, L232, L240, L247, L250, L253, L255, L258, L259, L262, L264, L267, L270

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Entry/Office Lock	10XG05 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Silencer	608		RO	087100

Set: 39.0

NOT USED

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Entry/Office Lock	10XG05 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 Surface Overhead Stop	10-X36 (Size as Required)	630	RF	087100
1 Silencer	608		RO	087100

Set: 40.0

Doors: L105, L119

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Entry/Office Lock	10XG05 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100

1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Silencer	608		RO	087100

Set: 41.0

Doors: C120, C122, L168, L170, L171A

6 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Self Latching Flush Bolt Set	2845 / 2945 (as required)	US26D	RO	087100
1 Dust Proof Strike	570	US26D	RO	087100
1 Classroom Lock	10XG37 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
2 Surf Overhead Stop	10-X36 (Size as Required)	630	RF	087100
2 Silencer	608		RO	087100

Set: 42.0

Doors: L160B

6 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Self Latching Flush Bolt Set	2845 / 2945 (as required)	US26D	RO	087100
1 Dust Proof Strike	570	US26D	RO	087100
1 Classroom Lock	10XG37 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 Coordinator	2600 Series x Mounting Brackets As Required	Black	RO	087100
2 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
2 Kick Down Door Holder	461	US26D	RO	087100
2 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
2 Silencer	608		RO	087100

Notes: Doors Open to 180 Degrees

Set: 43.0

Doors: L210, L263, L266

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
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1 Classroom Lock	10XG37 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Silencer	608		RO	087100

Set: 44.0

Doors: L125A

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Classroom Lock	10XG37 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 Surface Closer	351 CPS (HD Cush STP Arm)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
3 Silencer	608		RO	087100

Set: 45.0

Doors: 109, L123, L127, L128, L130, L131, L132, L133, L134, L135, L136, L137, L138, L139, L140, L141, L142, L143, L144, L145

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Classroom Lock	10XG37 LL SC (Keyed to Owner's Existing Key system)	US26D	SA	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Acoustic Corner Pads	ACP112BL/2		PE	087100
1 Acoustic Perimeter Gasketing	315CR (Head and Jambs)		PE	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100
1 Acoustic Door Bottom	STC4131CPK x Door Width		PE	087100

Set: 46.0

Doors: 107, 108, B101, D108, L111, L112, L196, L200, L201, L274, L275, L276, Z303, Z304

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Privacy Lock	10XU65 LL	US26D	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Silencer	608		RO	087100

Set: 46.1

Doors: E102

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Privacy Lock	V21 8265 LNL	US32D	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100

Set: 47.0

Doors: C117

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Privacy Lock	V21 8265 LNL	US32D	SA	087100
1 Surface Closer (Tri-Pack)	1431 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100

Set: 48.0

Doors: C108, C109, C110, C111

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Privacy Lock	V21 8265 LNL	US32D	SA	087100
1 Surface Closer (Tri-Pack)	1431 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Silencer	608		RO	087100

Notes: Doors Swing to 180 Degrees

Set: 49.0

Doors: C123, C124A, C124B, D104, D109, D112, E101, L103, L213, L249A, L249B, L268, L271A, L271B, L272, X119

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Passage Latch	10XU15 LL	US26D	SA	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100

3 Silencer 608 RO 087100

Notes: D104, D109 Open to 180 Degrees

Set: 50.0

Doors: C112, C113, C114, C115, C116

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Passage Latch	10XU15 LL	US26D	SA	087100
1 Surf Overhead Stop	10-X36 (Size as Required)	630	RF	087100
3 Silencer	608		RO	087100

Set: 50.1

Doors: D122, D123, D124, D125

3 Existing	Reused Existing Hinges		OT	
1 Existing	Reuse Existing Lockset		OT	
1 Surf Overhead Stop	10-X36 (Size as Required)	630	RF	087100
3 Silencer	608		RO	087100

Set: 51.0

Doors: L243

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Passage Latch	10XU15 LL	US26D	SA	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100
1 Acoustic Door Bottom	STC4131CPK x Door Width		PE	087100

Set: 51.1

Doors: L244

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Passage Latch	10XU15 LL	US26D	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100

Set: 52.0

Doors: L180

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Passage Latch	10XU15 LL	US26D	SA	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100

Notes: Provide Provisions for future card access at these openings.

Set: 52.1

Doors: L181, L184

3 Hinge, Full Mortise	TA2714 (NRP and size as required)	US26D	MK	087100
1 Passage Latch	10XU15 LL	US26D	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100

Notes: Provide Provisions for future card access at these openings.

Set: 53.0

Doors: L114

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Passage Latch	10XU15 LL	US26D	SA	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Electromagnetic Holder	998M	689	RF	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100

Notes: Operation:

Doors normally held open by electromagnetic holders and will be released to close upon activation of fire alarm.

Power to electromagnetic holders and relay to fire alarm by others.

Set: 54.0

Doors: 105, 106

3 Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP and size as required)	US26D	MK	087100
1 Push Plate	70C-RKW	US32D	RO	087100
1 Pull	RM3020-12 Mtg-Type 12XHD	US32-316	RO	087100
1 Surface Closer (Tri-Pack)	351 UO (RA or PA Mount as Required)	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Silencer	608		RO	087100

Set: 55.0

Doors: L189B, L190B

1 By Door/Frame Supplier	Sliding Door Hardware by Sliding Door/Frame Supplier		OT	
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Set: 56.0

Doors: MISC

1 Key Control Software	SIMPLE K		MC	087100
1 Repair Kit	QC-R001		MK	087100
1 Crimp Tool	QC-R003		MK	087100
1 Test Unit	WT2		SA	087100

END OF SECTION 087100

SECTION 087113 - AUTOMATIC DOOR OPERATORS

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. Low energy automatic door operators for swinging doors.

- B. Related Sections:

- 1. Division 01 Section "General Conditions".
- 2. Division 08 Section "Door Schedule".
- 3. Division 08 Section "Hollow Metal Doors and Frames".
- 4. Division 08 Section "Flush Wood Doors".
- 5. Division 08 Section "Door Hardware".
- 6. Division 26 Section "Electrical".

- A. Codes and Standards: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- 2. ANSI/BHMA A156.4 - Door Controls, Door Closers.
- 3. ANSI/BHMA A156.19 - Power Assist and Low-Energy Power Operated Doors.
- 4. ICC/IBC - International Building Code.
- 5. NFPA 70 - National Electrical Code.
- 6. NFPA 80 - Fire Doors and Windows.
- 7. NFPA 101 - Life Safety Code.
- 8. NFPA 105 - Installation of Smoke Door Assemblies.
- 9. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
- 10. UL 325 - Door, Drapery, Gate, Louver, and Window Operators and Systems.
- 11. State Building Codes, Local Amendments.

1.3 PERFORMANCE REQUIREMENTS

- A. Automatic door operators to be used on interior or exterior doors; up to 200 pounds (91 kg) weight and maximum door width of 48" (1219 mm).

1. Auto door operator capable of operating within temperature ranges of -22°F (-30°C) and 122°F (50°C).

1.4 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators, including activation devices. Include operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: Include details and attachments to other work.
 1. Include locations and elevations of each unique entrance showing activation devices.
 2. Indicate required clearances, components, and location and size of field connections.
 3. Wiring Diagrams: For power, signal, and activation wiring.
- C. Qualification Data: Provide copy of manufacturer's official certification or accreditation document indicating proof of status as a qualified and authorized installer of automatic door operators and accessories.
- D. Operating and Maintenance Manuals: Provide manufacturer's operating and maintenance manual for each item comprising the automatic door operator installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturer and Installer providing the operators and installation. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.
- E. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.
- B. Certified Installer Qualifications: Power operator products and accessories are required to be supplied and installed through the Norton Preferred Installer (NPI) program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.
- C. Source Limitations: Obtain automatic door operators, including activation devices, from single source, qualified supplier unless otherwise indicated.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

- E. Exit Door Requirements: Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.
- F. Fire Rated Door Assemblies: Provide operators for fire rated door assemblies that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for use on types and sizes of labeled fire doors required.
- G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and the procedures for receiving, handling, and installing automatic door operators.
 - 1. Prior to installation of automatic door operators, arrange for certified Installer's representative to conduct a project specific meeting to review the installation and maintenance of their respective products. Project meeting to be attended by representatives of related trades furnishing and installing the aluminum, hollow metal and wood doors sections.
 - 2. Review and finalize construction schedule and verify availability of materials.

1.6 COORDINATION

- A. Electrical Systems Coordination: Coordinate the layout and installation of scheduled automatic door operators and related activation devices, with required connections to source power junction boxes, remote power supplies, access control equipment, detection and monitoring hardware, and fire alarm system.
- B. Templates: Obtain and distribute to the parties involved, templates for doors, frames, operators, and other work specified to be factory prepared and reinforced for installing automatic door operators. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.
- C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified automatic door operators 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. Special Warranty: Written warranty, executed by manufacturer, agreeing to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period after final acceptance by Owner. Failures include, but are not limited to, the following:
 - 1. Faulty or sporadic operation of automatic door operator, including activation and safety devices.
 - 2. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
- C. Special Warranty Period: Two years from date of Substantial Completion.
- D. Provide extended warranty from defects in material or workmanship under normal use for a period of 3 years from the date of substantial completion for units installed by a certified ASSA ABLOY Power Operator Preferred Installer in accordance with the manufacturer's written warranty certificate.

1.8 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance by skilled employees of automatic door operator Installer. Include planned and preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
- B. Extended Maintenance Support and Service Agreement: Submit for Owner's consideration an optional extended Service Agreement for the installed automatic door operator system. The extended Service Agreement is considered elective and is without manufacturer's requirement stipulating mandatory coverage for owner and/or vendor system support.
 - 1. A published copy of this agreement to be included with the submittal package
 - 2. Support for the installed automatic door operator system is provided through the vendor under a specified, limited 24 hour support program.
 - 3. Automatic door operators and components are to be available on a one-day turn around time frame from the vendor.

PART 2 - PRODUCTS

2.1 ELECTROMECHANICAL DOOR OPERATORS

- A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.

1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
 - B. Standard: Certified ANSI/BHMA A156.19.
 - C. Performance Requirements:
 1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
 2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.
 - D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.
 - E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19.
 - F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.
 - G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.
 - H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
 - I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Norton Door Controls (NO) - 6300 Series.
- 2.2 ACTIVATION DEVICES
- A. General: Provide activation devices in accordance with ANSI/BHMA A156.19 standard, for condition of exposure indicated and for long term, maintenance free operation under normal traffic load operation. Coordinate activation control with electrified hardware and access control interfaces. Activation switches are standard SPST, with optional DPDT availability.
 - B. Push-Plate Switch: Momentary contact door control switch with push-plate actuator.

1. Configuration: Square or round push-plate control switch with single or double gang junction box mounting. Provide narrow profile face plate where indicated for jamb or mullion mounting.
 - a. Mounting Location: As indicated on Drawings.
 2. Push-Plate Material: Stainless steel.
 3. Message: International symbol of accessibility with "Push (Press) to Open (Operate)" text.
 4. Manufacturers:
 - a. Norton Door Controls (NO) – 500 Series.
- C. Key Switch: Key controlled actuator device enclosed in single or double gang junction box.
1. Faceplate Material: Stainless steel.
 2. Functions: On-off, maintained contact.
 3. Two-way Mounting: Recess or surface mounting as indicated on Drawings.
 4. Manufacturers:
 - a. Alarm Controls (AK) – MCK Series.
 - b. Securitron (SU) – MKA Series.
 - c. Wikk Industries (WI) – KS Series.
- D. Bollard Switch Post: Manufacturer's standard. Surface Mounted (above ground). Prepared for indicated switch types.
1. Where required, prepare bollard posts for card readers.
 2. Manufacturers:
 - a. LCN Closers (LC) – 866 Series.
 - b. Norton Door Controls (NO) – 500POST Series.

2.3 ACCESSORIES

- A. Relay Logic Modules: Module containing 3 relays allowing the operator to be used with external locking hardware (exits or locks) or access controls that require dry contact inputs.
1. Manufacturers:
 - a. Norton Door Controls (NO) – 5900RLM Series.
- B. Signage: As required by cited ANSI/BHMA A156.19 standard for the type of operator.

2.4 FINISHES

- A. Standard: Designations used to 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. Units will be sprayed with a combination of waterborne acrylic and polyester powder coat.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.5 OPENING LABELS

- A. Provide 1"W x 2"H gloss polyester label imprinted with door mark and QR-type code readable via IR and visible light scan. QR code links to a security credential protected site displaying the installed door opening information. Label constructed with a high-performance, permanent acrylic adhesive resistant to chemicals, smear and scratch, and repeated freeze and thaw cycles. Face stock of label to be white or clear coated, 2.0 mil thickness with tensile strength meeting or exceeding 18,000 psi.
 - 1. Approved Manufacturer: Openings Studio™ Smart Tags (AA).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, power connections, electrical systems interfaces, and other conditions affecting performance of automatic door operators.
- 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 INSTALLATION

- A. General: Install complete automatic door operators according to manufacturer's written instructions and ANSI/BHMA A156;19 standard, including activation devices, control wiring, remote power units if any, connection to the building's fire alarm system, and required signage.

- B. Power Connection: Reference Division 26 "Electrical" Sections for connection to electrical power distribution system.
- C. Access Control System: Coordinate connections and operation with access control system
- D. Signage: Apply signage as required by ANSI/BHMA A156.19 standard for type of door operator and direction of pedestrian travel.

3.3 ADJUSTING

- A. Comply with requirements of ANSI/BHMA A156.19 standard. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer.

3.4 DEMONSTRATION

- A. Certified Installer's representative to provide eight (8) hours of training to Owner's maintenance personnel in the proper adjustment, operation, and maintenance of automatic door operators.

END OF SECTION 087113

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
1. Insulating glass.
 2. Spandrel glass.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturers of fabricated glass units.
- B. Product Certificates: For glass.
- C. Product Test Reports: For fabricated glass, and, glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Glass: Obtain glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.

3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
 4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
 - 1. Manufacturers: Subject to compliance with requirements, :
 - a. AGC Glass Company North America, Inc.
 - b. Guardian Glass LLC
 - c. Pilkington North America; NSG Group
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- C. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.
- D. Ceramic-Coated Vision Glass: ASTM C1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in NGA's "Engineering Standards Manual."
- E. Silicone-Coated Spandrel Glass: ASTM C1048, Type I, Condition C, 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 in accordance with ASTM E2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

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 of industry colors.
- B. Neutral-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.
 - b. Polymeric Systems, Inc
 - c. The Dow Chemical Company
 - d. Tremco Incorporated (Tremsil 200 or equal)

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 C1281 and AAMA 800 for products indicated below:
 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 1. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 1. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
 1. Type recommended in writing by sealant or glass manufacturer.

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.

- F. 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.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.7 MONOLITHIC GLASS SCHEDULE

A. Clear Glass Type: Fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

3.8 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type: (As indicated on the Drawings)

1. Overall Unit Thickness: 1 inch.
2. Minimum Thickness of Each Glass Lite: 6 mm.
3. Outdoor Lite: Clear float glass.
4. Tint Color: As selected by Architect from manufacturer's full range.
5. Interspace Content: Argon.
6. Indoor Lite: Clear float glass.
7. Low-E Coating: Pyrolytic or sputtered on second or third surface.
8. Winter Nighttime U-Factor: .29 maximum.
9. Summer Daytime U-Factor: .29 maximum.
10. Visible Light Transmittance: 44 percent minimum.
11. SGHC: .52 maximum.
12. Safety glazing as required.

B. Low-E-Coated, Tinted Insulating Glass Type: (As indicated on the Drawings)

1. Overall Unit Thickness: 1 inch.
2. Minimum Thickness of Each Glass Lite: 6 mm.
3. Outdoor Lite: Tinted float glass.
4. Tint Color: As selected by Architect from manufacturer's full range.
5. Interspace Content: Argon.
6. Indoor Lite: Clear float glass.
7. Low-E Coating: Pyrolytic or sputtered on second or third surface.
8. Winter Nighttime U-Factor: .29 maximum.
9. Summer Daytime U-Factor: .29 maximum.
10. Visible Light Transmittance: 44 percent minimum.
11. SGHC: .52 maximum.
12. Safety glazing as required.

C. Ceramic, Silicone-Coated, Low-E, Insulating Spandrel Glass Type: (As indicated on the Drawings)

1. Coating Color: As selected by Architect from manufacturer's full range.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: float glass.
5. Interspace Content: Argon.
6. Indoor Lite: float glass.

7. Low-E Coating: Pyrolytic or sputtered on second or third surface.
8. Opaque Coating Location: Fourth surface.
9. Winter Nighttime U-Factor: .29 maximum.
10. Summer Daytime U-Factor: .29 maximum.

END OF SECTION 088000

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SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gypsum board shaft wall assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and support them on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with gypsum-shaftliner-board manufacturer's written instructions.
- B. Do not install finish panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

- A. Fire-Resistance Rating: As indicated on Drawings.
- B. Gypsum Shaftliner Board:
 - 1. Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with paper faces, 1 inch thick, with double beveled long edges.
 - a. Manufacturers: Subject to compliance with requirements, :
 - 1) CertainTeed; SAINT-GOBAIN
 - 2) Georgia-Pacific Gypsum LLC
 - 3) USG Corporation
- C. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:
 - 1. Depth: As indicated.
 - 2. Minimum Base-Metal Thickness: 0.030 inch.
- D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
 - 1. Minimum Base-Metal Thickness: Matching steel studs.

2.3 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - 1. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
- E. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch minimum thickness of base metal (uncoated).

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.
- B. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.
- C. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.
- D. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- E. Control Joints: Install control joints at locations indicated on Drawings while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

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, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to,

- discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116.23

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Notify manufacturer of damaged materials received prior to installation.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and

classified according to ASTM E413 by an independent testing agency.

- C. Horizontal Deflection: For composite and non-composite wall assemblies, limited to L/240 or L/360 to max. deflection of 1/2 inch. on horizontal loading of 5 lbf/sq. ft..
- D. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.
- E. Design Loads: 5 lb /sq. ft. minimum as required by the IBC.
- F. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 1 inches in both the upward and downward direction.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with AISI S220 and ASTM C645, Section 10 for conditions indicated.
 - 1. Steel Sheet Components: Comply with AISI S220 and ASTM C645, Section 10 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
 - a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Track: ASTM C645.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ClarkDietrich
 - b. MBA Building Supplies
 - c. Steel Network, Inc. (The)
 - d. Telling Industries
 - 2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
 - 3. Depth: As indicated on Drawings.
 - 4. Spacing: As required by performance requirements for horizontal deflection.
- C. Slip-Type Head Joints: Where indicated, provide the following:
 - 1. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer

- track sized to friction-fit over inner track.
2. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Manufacturers: Subject to compliance with requirements, :
 - 1) ClarkDietrich
 - 2) MBA Building Supplies
 - 3) Steel Network, Inc. (The)
 - 4) Telling Industries

D. Hat-Shaped, Rigid Furring Channels: ASTM C645.

1. Manufacturers: Subject to compliance with requirements, :
 - a. ClarkDietrich
 - b. MBA Building Supplies
2. Minimum Base-Steel Thickness: 0.0329 inch.
3. Depth: As indicated on Drawings.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
 1. Depth: 2-1/2 inches.
- D. Furring Channels (Furring Members):
 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 2. Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: 0.0329 inch.
 - b. Depth: As indicated on Drawings.
 3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
 - a. Minimum Base-Steel Thickness: 0.0329 inch.

FACILITY RENOVATION
2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings required by referenced installation standards for assembly types.

- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches o.c.
 - 2. Carrying Channels (Main Runners): 48 inches o.c.
 - 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 079200 "Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
3. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum board, Type X.
2. Mold-resistant gypsum board.
3. Gypsum board, Type C.
4. Sound-attenuation blankets.

B. Samples for Verification: For the following products:

C. Sustainable Design Submittals:

1.3 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.3 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed; SAINT-GOBAIN
 - b. Georgia-Pacific Gypsum LLC
 - c. USG Corporation
 - 2. Thickness: 5/8 inch.
 - 3. Long Edges: Tapered.
- B. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-

resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed; SAINT-GOBAIN
 - b. Georgia-Pacific Gypsum LLC
 - c. USG Corporation
2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed; SAINT-GOBAIN
 - b. Georgia-Pacific Gypsum LLC
 - c. USG Corporation
2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
3. Long Edges: Tapered.

2.6 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. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Sealant: As specified in Section 079200 "Joint Sealants."
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- F. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: As indicated on Drawings.
 - 2. Mold-Resistant Type: As indicated on Drawings.
 - 3. Type C: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 - 1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-

layer joints unless otherwise indicated or required by fire-resistance-rated assembly.
Stagger joints on opposite sides of partitions.

2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

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SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 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: Class A according to ASTM E1264.
 - 2. Smoke-Developed Index: 450 or less.

2.3 ACOUSTICAL PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ceiling and Wall Solutions, as indicated on the Drawings.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Color: White.
- D. Modular Size: 24 by 24 inches unless noted otherwise.
- E. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.4 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ceiling and Wall Solutions, "Prelude XL to match existing.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip

galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel, or, aluminum.
5. Cap Finish: Painted white.

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. Wire Hangers, Braces, and Ties: Provide wires as follows:
 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.
- C. Hold-Down Clips: Manufacturer's standard hold-down where indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 3. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 4. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 5. Do not attach hangers to steel deck tabs.
 - 6. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 7. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
 - 1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.
 - 2. For reveal-edged panels on suspension-system runners, install panels with bottom of

- reveal in firm contact with top surface of runner flanges.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 4. Install hold-down clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
 - a. Hold-Down Clips: Space 24 inches o.c. on all cross runners.
 5. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

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SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoset-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 Initial Selection: For each type of product indicated.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Tarkett, Johnsonite Baseworks Wall Base.
- B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style: Style B, Cove.
- C. Thickness: 0.125 inch.
- D. Height: 4 inches, or 6 inches, as indicated on Drawings.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors: As indicated on the Drawings.

2.2 RUBBER STAIR ACCESSORIES

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Tarkett, Johnsonite Angle Fit Rubber Stair Treads, Risers and Nosings.
- C. Stair Treads: ASTM F2169.
 - 1. Type: TS (rubber, vulcanized thermoset).
 - 2. Class: 2 (pattern; embossed – Raised Round Tread RNRD).
 - 3. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
 - 4. Nosing Height: 2 inches.

5. Thickness: 1/4 inch and tapered to back edge.
 6. Size: Lengths and depths to fit each stair tread in one piece.
- D. 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 high by length matching treads.
 2. Thickness: Manufacturer's standard.
- E. Separate Nosings: Vinyl stair nosing for carpet treads and risers (C-2) in Stair 2, Room 102 (RCN XX A).
- F. Landing Tile: Carpet Tile (C-1).
- G. Locations: Provide rubber stair accessories in areas indicated on the Drawings.
- H. Colors and Patterns: As indicated on the Drawings.

2.3 RUBBER MOLDING ACCESSORY

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Tarkett, Johnsonite Adaptors.
- B. Description: Rubber reducer strips and transition strips, as required by standard installation recommended by manufacturer at carpet and resilient flooring material edges. (CTA-XX-A, CRS-XX-A)
- C. Colors and Configurations: As indicated on the Drawings.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
1. Adhesives shall have a VOC content of 50 g/L or less.
- 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum **75** percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 inches 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 6 inches in length.
 - a. Cope corners to minimize open joints.

3.4 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.
 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid vinyl floor tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 SOLID VINYL FLOOR TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Interface, Inc., Steady Stride Woodgrains Collection.
- B. Tile Standard: ASTM F1700.
 - 1. Class: Class III, Printed Film Vinyl Tile.
- C. Thickness: 3.0 mm.
- D. Size: 12.5 cm x 1 m.

- E. Colors and Patterns: As selected from manufacturer's full range of standard wood grain colors.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation

only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

- b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Bricked installation pattern.
 - 2. Install wood grain in direction as indicated on the Drawings in a random pattern.
- 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.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor tile until Substantial Completion.

END OF SECTION 096519

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SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular carpet tile.
2. Broadloom carpet for treads and risers in one stair.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories", Section 096519 "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.

1.8 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.9 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 1. Warranty does not include deterioration or failure of carpet tile due to unusual

- 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
- 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE (C-1)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Interface, Inc., Redo Collection, Reincarnation.
- B. Color: Earthtone.
- C. Size: 19.69 by 19.69 inches.
- D. 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.
- E. Performance Characteristics:
 - 1. Appearance Retention Rating: Severe traffic, 3.5 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 according to ASTM D2646.

2.2 STAIR CARPET (C-2)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product as indicated on the Drawing.

B. 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.

C. Performance Characteristics:

1. Appearance Retention Rating: Severe traffic, 3.5 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 according to ASTM D2646.

2.3 CARPET TILE (MAT-1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Shaw Contract, Collection Stepping Out, Welcome II Tile.

B. Color: Black Chocolate.

C. Size: 24 by 24 inches.

D. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.

E. Performance Characteristics:

1. Appearance Retention Rating: Severe traffic, 3.5 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 according to ASTM D2646.

2.4 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.

1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM 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.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

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 wide or wider, and protrusions more than 1/32 inch 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. 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: Quarter turn.
- 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.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.
- C. 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 096813

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SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Finish coatings.

B. Related Requirements:

1. Section 099300 "Staining and Transparent Finishing" for surface preparation and application of wood stains and transparent finishes on exterior wood substrates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.

C. Samples: For each type of topcoat product.

D. Product Schedule: Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PRIMERS

- A. Exterior, Alkyd/Oil Wood Primer: Alkyd/oil-based primer that is resistant to extractive bleeding when applied to wood substrates with less than 15 percent moisture content; formulated for sag, mold, and microbial resistance; for hiding stains; and for use on exterior wood subject to extractive bleeding.
 1. Manufacturers: Subject to compliance with requirements, :
 - a. Benjamin Moore & Co.
 - b. Sherwin-Williams Company (The)
 - c. Behr Paint Company; Behr Process Corporation
- B. Alkyd Metal Primer: Corrosion-resistant, solvent-based, alkyd primer formulated for use on prepared ferrous metals subject to industrial and light marine environments.
 1. Manufacturers: Subject to compliance with requirements, :
 - a. Benjamin Moore & Co.
 - b. Sherwin-Williams Company (The)
 - c. Behr Paint Company; Behr Process Corporation.
- C. Water-Based, Galvanized-Metal Primer: Corrosion-resistant, pigmented, acrylic primer; formulated for use on cleaned/etched, exterior, galvanized metal to prepare it for subsequent water-based coatings.
 1. Manufacturers: Subject to compliance with requirements, :
 - a. Behr Paint Company; Behr Process Corporation
 - b. Benjamin Moore & Co.
 - c. Sherwin-Williams Company (The)

2.2 FINISH COATINGS

- A. Exterior Alkyd Enamel, Semigloss: Solvent-based, pigmented, alkyd enamel formulated for mold, microbial, and water resistance and for use on exterior, primed, wood and metal surfaces.
 - 1. Manufacturers: Subject to compliance with requirements, :
 - a. Behr Paint Company; Behr Process Corporation
 - b. Sherwin-Williams Company (The)
 - c. Benjamin Moore & Co.
 - 2. Gloss Level: Manufacturer's standard semigloss finish.
- B. Exterior, Water-Based, Light Industrial Coating, Semigloss: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.
 - 1. Manufacturers: Subject to compliance with requirements:
 - a. Behr Paint Company; Behr Process Corporation
 - b. Sherwin-Williams Company (The)
 - c. Benjamin Moore & Co.
 - 2. Gloss Level: Manufacturer's standard semigloss finish.
- C. Exterior, Water-Based, 100% Acrylic Coating, Low Sheen: Water based, pigmented coating, formulated for mold, microbial and water resistance for use on exterior surfaces.
 - 1. Manufacturers: Subject to compliance with requirements:
 - a. Behr Paint Company; Behr Process Corporation
 - b. Sherwin-Williams Company (The)
 - c. Benjamin Moore & Co.
 - 2. Gloss Level: Manufacturer's standard low sheen finish.

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. Fiber-Cement Board: 12 percent.
 2. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with 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 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.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
1. SSPC-SP 2.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Wood Substrates:
1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 2. Sand surfaces that will be exposed to view, and remove sanding dust.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic

wood filler. Sand smooth when dried.

3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.

3. Allow empty paint cans to dry before disposal.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Steel and Iron Substrates:
 1. Water-Based, Light Industrial Coating System:
 - a. Prime Coat: Alkyd metal primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Exterior, water-based, light industrial coating, semigloss.
- B. Galvanized-Metal Substrates:
 1. Water-Based, Light Industrial Coating System:
 - a. Prime Coat: Water-based, galvanized-metal primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Exterior, water-based, light industrial coating, semigloss.
- C. Dressed-Lumber Substrates: Trim.
 1. Alkyd System:
 - a. Prime Coat: Exterior, alkyd/oil wood primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Exterior alkyd enamel, semigloss.
- D. Fiber Cement Board Substrates: Siding, Trim, Soffit Panels.
 1. Acrylic System (Per Fiber Cement Board Manufacturer's Recommendation)
 - a. Prime Coat: By Manufacturer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Exterior 100% acrylic paint, low sheen.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Water-based finish coatings.
3. Solvent-based finish coatings.

B. Related Requirements:

1. Section 055113 "Metal Pan Stairs" for shop priming metal pan stairs.
2. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Label each Sample for location and application area.

C. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
 - 1. Behr Paint Company; Behr Process Corporation
 - 2. Benjamin Moore & Co.
 - 3. Sherwin-Williams Company (The).
- B. Source Limitations: Obtain each paint product from a single manufacturer.
- C. 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.
- D. VOC Content, LEED 2009: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Primers, Sealers, and Undercoaters: 200 g/L.
 - 4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.

- E. Colors: As indicated in a color schedule.

2.2 PRIMERS

- A. Interior/Exterior Latex Block Filler: Water-based, high-solids, emulsion coating formulated to bridge and fill porous surfaces of exterior concrete masonry units in preparation for specified subsequent coatings.
 - 1. Manufacturers: Subject to compliance with requirements:
 - a. Behr Paint Company; Behr Process Corporation
 - b. Benjamin Moore & Co.
 - c. Sherwin-Williams Company (The)
- B. Alkali-Resistant, Water-Based Primer: Water-based primer formulated for use on alkaline surfaces, such as plaster, vertical concrete, and masonry.
 - 1. Manufacturers: Subject to compliance with requirements:
 - a. Behr Paint Company; Behr Process Corporation
 - b. Benjamin Moore & Co.
 - c. Sherwin-Williams Company (The)
- C. Interior, Institutional Low-Odor/VOC Primer Sealer: Water-based primer sealer with low-odor characteristics and a VOC of less than 10 grams per liter for use on new interior plaster, concrete, and gypsum wallboard surfaces that are subsequently to be painted with latex finish coats.
 - 1. Manufacturers: Subject to compliance with requirements:
 - a. Behr Paint Company; Behr Process Corporation
 - b. Benjamin Moore & Co.
 - c. Sherwin-Williams Company (The)

2.3 WATER-BASED FINISH COATS

- A. Interior, Latex, Institutional Low Odor/VOC, Eggshell: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.
 - 1. Manufacturers: Subject to compliance with requirements:
 - a. Behr Paint Company; Behr Process Corporation
 - b. Benjamin Moore & Co.
 - c. Sherwin-Williams Company (The)

2. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- B. Interior, Water-Based Light-Industrial Coating, Semigloss: Pigmented, water-based emulsion coating for interior primed wood and metal surfaces (e.g., walls, doors, frames, trim, and sash), providing resistance to moderate abrasion and mild chemical exposure and corrosive conditions.
1. Manufacturers: Subject to compliance with requirements:
 - a. Behr Paint Company; Behr Process Corporation
 - b. Benjamin Moore & Co.
 - c. Sherwin-Williams Company (The)
 2. Gloss Level: Manufacturer's standard semigloss finish.

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. Masonry (Clay and CMUs): 12 percent.
 2. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 - 3. Allow empty paint cans to dry before disposal.
 - 4. Collect waste paint by type and deliver to recycling or collection facility.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or

defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Institutional Low-Odor/VOC Latex System:

- a. Block Filler: Interior/exterior latex block filler.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, latex, institutional low odor/VOC, eggshell.

B. Steel Substrates:

1. Water-Based Light-Industrial Coating System:

- a. Prime Coat: Primer, rust-inhibitive, water based.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, water-based, light-industrial coating, semigloss.

C. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System:

- a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, latex, institutional low odor/VOC, eggshell.

2. Water-Based Single Component Acrylic Epoxy System:

- a. Prime Coat: As recommended for topcoat.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, water-based, epoxy, semigloss.

END OF SECTION 099123

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SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Wood stains.
 2. Transparent finishes.

1.2 ACTION SUBMITTALS

- A. Product Data:
1. For each type of product.
 2. Include preparation requirements and application instructions.
 3. Indicate VOC content.
- B. Samples for Verification: Sample for each type of finish system and in each color and gloss of finish required on representative samples of actual wood substrates.
1. Size: 8 inches square.
 2. Apply coats on Samples in steps to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- 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.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.4 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures of less

than 5 deg F above the dew point, or to damp or wet surfaces.

- C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations: Obtain each coating product from single source from single manufacturer.

2.2 STAINING AND TRANSPARENT FINISHING

- A. Manufacturers: Subject to compliance with requirements:
 - 1. Behr Paint Company; Behr Process Corporation
 - 2. Benjamin Moore & Co.
 - 3. Sherwin-Williams Company (The)
- B. 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.
- C. VOC Content, LEED 2009: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Clear Wood Finishes, Varnishes: 350 g/L.
 - 2. Stains: 250 g/L.
- D. Stain Colors: Match Architect's samples.

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.

2.4 TRANSPARENT FINISHES

- A. Varnish, Interior, Flat/Satin: Solvent-based, alkyd-type, clear flat/satin varnish for new or properly prepared, previously varnished interior wood surfaces.

1. Gloss and Sheen Level: Manufacturer's standard flat finish.

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 Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with finish application only after unsatisfactory conditions have been corrected.
 1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

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.
- C. Interior Wood Substrates:
 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 2. Apply wood filler paste to open-grain woods to produce smooth, glasslike finish.
 3. Sand surfaces exposed to view and dust off.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for finish and substrate indicated.
 - 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
 - 3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- 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. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. 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.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

END OF SECTION 099300

SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for blocking.
2. Section 102800 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS

A. Product Data.

1. Phenolic-core toilet compartments.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.

1. Include Samples of hardware and accessories involving material and color selection.

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

E. Sustainable Design Submittals:

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For toilet compartments.

1.4 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain phenolic-core toilet compartments from single source from single manufacturer.

2.2 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: 200 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.

2.3 PHENOLIC-CORE TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Sanitary Partition Corporation
 - 2. Bobrick Washroom Equipment, Inc
 - 3. Bradley Corporation
 - 4. Knickerbocker Partition Corporation
 - 5. Metpar Corp
- B. Toilet-Enclosure Style: Overhead braced.
- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel, and Pilaster Construction: Solid phenolic-core material with melamine facing

on both sides fused to substrate during manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch- thick doors and pilasters and minimum 1/2-inch- thick panels.

- E. Urinal-Screen Construction: Matching panel construction.
- F. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- G. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- H. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design, stainless steel.
- I. Phenolic Compartment Finish: One color in each room.
 - 1. Through-Color Phenolic: Manufacturer's standard solid through-color.
 - a. Color: As selected by Architect from manufacturer's full range.

2.4 HARDWARE AND ACCESSORIES

- A. Door Hardware and Accessories, Heavy Duty: Manufacturer's heavy-duty institutional operating hardware and accessories.
 - 1. Hinges: Manufacturer's minimum 0.062-inch- thick, stainless steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through bolts.
 - 2. Latch and Keeper: Manufacturer's heavy-duty, surface-mounted, cast stainless steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible. Mount with through bolts.
 - 3. Coat Hook: Manufacturer's heavy-duty, combination cast stainless steel hook and rubber-tipped bumper, sized to prevent in swinging door from hitting compartment-mounted accessories. Mount with through bolts.
 - 4. Door Bumper: Manufacturer's heavy-duty, rubber-tipped, cast stainless steel bumper at out swinging doors. Mount with through bolts.
 - 5. Door Pull: Manufacturer's heavy-duty, cast stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible. Mount with through

bolts.

- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with anti-grip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match 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.

2.5 MATERIALS

- A. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- B. Stainless Steel Castings: ASTM A743/A743M.

2.6 FABRICATION

- A. 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: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in swinging doors for standard toilet enclosures and 36-inch- wide, out swinging doors with a minimum 32-inch- wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 or Screens: 1/2 inch.
 - b. Panels or Screens and Walls: 1 inch.
 - 2. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with 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 102113.17

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SECTION 102123 - CUBICLE CURTAINS AND TRACK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cubicle-curtain support systems.
 - 2. Cubicle curtains.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For each type of curtain fabric indicated, include durability, laundry temperature limits, fade resistance, applied curtain treatments, and fire-test-response characteristics.
- B. Samples for Initial Selection: For each type of curtain material indicated.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For curtains, tracks, and hardware to include in operation and maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Curtain Carriers and Track End Caps: Full-size units equal to 3 percent of amount installed for each size indicated, but no fewer than 10 units.
 - 2. Curtains: Full-size units equal to 10 percent of amount installed for each size indicated, but no fewer than two units.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Cubicle Curtains: Provide curtain fabrics with the following characteristics:
 - 1. Laundering: Launderable to a water temperature of not less than 160 deg F.
 - 2. Flame Resistance: Provide fabrics identical to those that have passed NFPA 701 when tested by a qualified testing agency acceptable to authorities having jurisdiction.
 - a. Identify fabrics with appropriate markings of a qualified testing agency.

2.2 CUBICLE-CURTAIN SUPPORT SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Inpro Corp., Formatrac Bendable Track System or comparable product.
- B. PVC Curtain Track: Not less than 1/2 inches wide by 1 3/8 inch high.
 - 1. Curved Track: Factory-fabricated, 8-inch- radius bends.
- C. Curtain-Track Mounting: Surface.
- D. Curtain Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.
 - 1. End Stop: Removable with carrier hook.
- E. Curtain Glide Carriers: One-piece nylon glide with chrome-plated steel hook.
- F. Exposed Fasteners: Stainless steel.

2.3 CUBICLE CURTAINS

- A. Basis of Design Product: Subject to compliance with requirements, provide Inpro Corp., Gold Fabrics:
 - 1. Pattern and color: As selected by Architect from manufacturer's full range.
- B. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.
- C. Mesh Top: Not less than 18" high mesh top.

1. Mesh: No. 50 nylon mesh.
2. Color: Snow.

2.4 CURTAIN FABRICATION

A. Continuous Curtain Panels:

1. Width: Equal to track length from which curtain is hung plus 10 percent of added fullness, but not less than 12 inches of added fullness.
2. Length: Equal to floor-to-ceiling height, minus depth of track and carrier at top, and minus clearance above the finished floor of 12 inches.
3. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched.
4. Mesh Top: Top hem of mesh not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched. Double lockstitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric.
5. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, double thickness and double lock stitched.
6. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with double turned edges, and single lock stitched.
7. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install tracks level and plumb, according to manufacturer's written instructions.
- B. For tracks of up to 20 feet in length, provide track fabricated from single, continuous

length.

C. Track Mounting:

1. Surface-Track: Fasten tracks to ceilings at intervals recommended by manufacturer. Fasten tracks to structure at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
2. Mechanically fasten to furring through suspended ceiling with screw and tube spacer.
3. Attach track to suspended ceiling grid with manufacturer's proprietary clip.

D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

F. Cubicle Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

END OF SECTION 102123

SECTION 102239 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Operable acoustical panel partitions.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.

1.2 DEFINITIONS

A. NIC: Noise Isolation Class.

B. NRC: Noise Reduction Coefficient.

C. STC: Sound Transmission Class.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Operable acoustical panel partitions.

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.

C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

1. Include Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of operable panel partition.

- B. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.
- C. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - b. Seals, hardware, track, track switches, carriers, and other operating components.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties in accordance with test methods indicated:
 - 1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance in accordance with 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 in accordance

with ASTM C423, and rated for not less than the NRC indicated.

- B. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by a testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.

2.2 OPERABLE ACOUSTICAL PANEL PARTITIONS

- A. Operable Acoustical Panel Partitions: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Modernfold, Inc., Acousti-Seal Legacy or comparable product by one of the following:
 - a. KWIK-WALL Company
 - b. Moderco Inc
- B. Panel Operation: Manually operated, individual 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.
 - 1. Panel Width: As indicated.
- E. STC: Not less than 45.
- F. NRC: Not less than 0.65.
- G. Panel Weight: 8 lb/sq. ft. maximum.
- H. Panel Thickness: Nominal dimension of 3 inches.

- I. Panel Materials:
 - 1. Adhesives: Do not use adhesives that contain urea formaldehyde.
 - 2. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
 - 3. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.
- J. Panel Closure: Manufacturer's standard unless otherwise indicated.
- K. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
 - 1. Hinges: Manufacturer's standard.
- L. Finish Facing: Fabric wall covering.

2.3 SEALS

- A. Description: Seals that produce operable panel partitions complying with performance requirements and the following:
 - 1. Manufacturer's standard seals unless otherwise indicated.
 - 2. Seals made from materials and in profiles that minimize sound leakage.
 - 3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.
- B. Vertical Seals: Deep-nesting, interlocking steel astragals mounted on each edge of panel, with continuous, resilient acoustical seal.
- C. Horizontal Top Seals: Continuous-contact, resilient seal exerting uniform constant pressure on track.
- D. Horizontal Bottom Seals:
 - 1. Resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
 - a. Mechanically Operated for Acoustical Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than 1-1/2 inches between retracted seal and floor finish.

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 non staining adhesive as recommended by facing manufacturer's written instructions.
 - 1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with edges tightly butted, and with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
- 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, finished as follows:
 - 1. Aluminum: Finished with manufacturer's standard color anodic finish.

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 between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
 - 1. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
 - 1. Multidirectional Carriers: Capable of negotiating intersections without track switches.
- C. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.
- D. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

2.6 ACCESSORIES

- A. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware and acoustical seals at soffit, floor, and jambs. Hinges in finish to match other exposed hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine flooring, floor levelness, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF OPERABLE PANEL PARTITIONS

- A. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- B. Install panels in numbered sequence indicated on Shop Drawings.
- C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- D. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.
- E. 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.

3.3 ADJUSTING

- A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust storage pocket doors to operate smoothly and easily, without binding or warping.
- C. Verify that safety devices are properly functioning.

3.4 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 102239

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SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Corner guards.
 2. End-wall guards.
 3. Abuse-resistant wall coverings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
- C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.
1. Include Samples of accent strips and accessories to verify color selection.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.

2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. 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.
 1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARDS

- A. Surface-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Inpro Corporation, 160BN or comparable product by one of the following:
 - a. Construction Specialties, Inc.
 - b. Pawling Corporation
 2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; as follows:
 - a. Profile: Nominal 2-inch- long leg and 1/4-inch corner radius.
 - b. Height: As indicated on the drawings.
 - c. Color and Texture: As selected by Architect from manufacturer's full range.
 3. Continuous Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
 4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
 5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.4 END-WALL GUARDS

- A. Surface-Mounted, Plastic-Cover, End-Wall Guard: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over continuous retainer at each corner, with end of wall covered by semirigid, abuse-resistant wall covering; including mounting hardware.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Inrpo Corporation, 160D or comparable product by one of the following:
 - a. Construction Specialties, Inc.
 - b. Pawling Corporation
 2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; in dimensions and profiles indicated on Drawings.
 - a. Profile: Nominal 2-inch- long leg and 1/4-inch corner radius.
 - b. Height: As indicated on the drawings.
 - c. Color and Texture: As selected by Architect from manufacturer's full range.
 3. Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
 4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.5 ABUSE-RESISTANT WALL COVERINGS

- A. Abuse-Resistant Sheet Wall Covering: Fabricated from semirigid, plastic sheet wall-covering material.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Inrpo Corporation, Rigid Palladium Sheet or comparable product by one of the following:
 - a. Construction Specialties, Inc.
 - b. Pawling Corporation
 2. Size: As indicated.
 3. Sheet Thickness: 0.040 inch.
 4. Color and Texture: As selected by Architect from manufacturer's full range.
 5. Height: As indicated.
 6. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
 7. Mounting: Adhesive.

2.6 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral

color throughout; extruded and sheet material as required, thickness as indicated.

- B. Polycarbonate Plastic Sheet: ASTM D6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D256, Test Method A.
- C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- D. Adhesive: As recommended by protection product manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.

2.7 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.8 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
 - 2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
 - 3. Adjust end, and top caps as required to ensure tight seams.
- D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

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SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Healthcare accessories.
3. Hand dryers.
4. Childcare accessories.
5. Custodial accessories.

1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Public-use washroom accessories.
2. Healthcare accessories.
3. Hand dryers.
4. Childcare accessories.
5. Custodial accessories.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

- A. Owner-Furnished Materials:
 - 1. Toilet Tissue Dispensers: Owner furnished, and Contractor installed at locations as indicated on the drawings.
 - 2. Soap Dispensers: Owner furnished, and Contractor installed at locations as indicated on the drawings.

2.2 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 concentrated load applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Paper Towel (Folded) Dispenser:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., models B262 and B26212 or comparable product by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bradley Corporation

2. Mounting: Surface mounted.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
4. Lockset: Tumbler type.

C. Grab Bar:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., B-6806 or comparable product by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bradley Corporation
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch 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.
5. Configuration and Length: As indicated on Drawings.

D. Sanitary-Napkin Disposal Unit:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-270 or comparable product by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bradley Corporation
2. Mounting: Surface mounted.
3. Receptacle: Removable.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

E. Mirror Unit:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-290 or comparable product by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bradley Corporation
2. Frame: Stainless steel angle, 0.05 inch thick.
 - a. Corners: Welded and ground smooth.
3. Size: As indicated on Drawings.
4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

F. Hook:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., B-6707 or comparable product by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bradley Corporation
2. Description: Single-prong unit.
3. Mounting: Concealed.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.4 HEALTHCARE ACCESSORIES

A. Source Limitations: Obtain healthcare accessories from single source from single manufacturer.

B. Specimen Pass-Through Cabinet:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., B-505 or comparable product by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bradley Corporation
2. Description: Two-sided type, with self-closing, interlocking doors on both sides, that prevent both from being open at same time, and removable stainless steel tray.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.5 HAND DRYERS

A. Source Limitations: Obtain hand dryers from single source from single manufacturer.

B. Warm-Air Dryer:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-7128 or comparable product.
 - a. ASI-American Specialties, Inc.
 - b. Bradley Corporation
 - c. World Dryer Corporation (Zurn Industries, LLC)
2. Description: Standard-speed, warm-air hand dryer.
3. Mounting: Surface mounted.
 - a. Protrusion Limit: Installed unit protrudes maximum 4 inches from wall surface.

4. Operation: Infrared-sensor activated with timed power cut-off switch.
 - a. Automatic Shutoff: At 90 seconds.
5. Maximum Sound Level: 63 dB.
6. Cover Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
7. Electrical Requirements: 115 V, 15 A, 1725 W.

2.6 CHILDCARE ACCESSORIES

- A. Source Limitations: Obtain childcare accessories from single source from single manufacturer.
- B. Diaper-Changing Station:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Koala Kare, KB300 or comparable product by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bradley Corporation
 2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support minimum of 200 lb static load when opened.
 3. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
 4. Operation: By pneumatic shock-absorbing mechanism.
 5. Material and Finish: Injection-molded polypropylene. Color selected from manufacturer's standard..
 6. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

2.7 CUSTODIAL ACCESSORIES

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
- B. Custodial Mop and Broom Holder:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., B-224 or comparable product by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bradley Corporation

2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches.
4. Hooks: Threes.
5. Mop/Broom Holders: Four, 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- thick stainless steel.
 - b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.8 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- minimum nominal thickness.
- C. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- D. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.9 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. 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 in accordance with 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.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 102800

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SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

1. ASTM International (ASTM):
 - a. ASTM E814-11a (UL1479) standard testing method for fire tests of penetration fire stops.

2.3 FIRE-PROTECTION CABINET

- A. Fire-Protection Cabinet Type: Suitable for fire extinguisher.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. JL Industries Inc. – Ambassador Series
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Semi recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face with rolled back corners and wall return at outer edge (backbend).
 1. Rolled-Edge Trim: 2-1/2-inch backbend depth. (At 6 inch nominal wall thickness.)
 2. Rolled-Edge Trim: 4-inch backbend depth. (At 4 inch nominal wall thickness.)
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: 12 gauge steel sheet.
- G. Door Style: Fully glazed panel with frame.
- H. Door Glazing: Tempered glass.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 1. Provide projecting door pull and friction latch.
 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- J. Accessories:
 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2. Door Latch: Friction type, no lock.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

K. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: As selected by Architect from manufacturer's full range.
2. Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.
3. Rolled-Edge Trim: 2-1/2-inch or 4-inch backbend depth.
4. Continuous Hinge: Same material and finish as trim, permitting door to open 180 degrees.
5. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to security fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with baked-enamel finish.
6. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in security fire-protection cabinet with the words "FIRE EXTINGUISHER."
7. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors.

2.4 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.
 1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design,

- minimum 1/2 inch thick.
- 2. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semi recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.

2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification:

1. Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

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SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 3. Handles and Levers: Manufacturer's standard.
 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Location: Where indicated on the Drawings.
 - b. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
1. Mounting Height: Top of fire extinguisher to be at 42 inches above finished floor.

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Knocked-down corridor lockers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain metal lockers and accessories from single source from single locker manufacturer.

2.2 KNOCKED-DOWN CORRIDOR LOCKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hadrian Inc.; Zurn Industries, LLC
 - 2. Lyon LLC
 - 3. Republic Storage Systems, LLC
- B. Doors: One piece; fabricated from 0.060-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
 - 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
 - 2. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch nominal-thickness steel sheet; welded to inner face of doors.
 - 3. Door Style: Vented panel as follows:
 - a. Louvered Vents: No fewer than three louver openings at top and bottom for double-tier lockers.
- C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 - 1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
 - 2. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.
 - 3. Shelves: 0.024-inch nominal thickness, with double bend at front and single bend at sides and back.
- D. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into

vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
- E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches high. Provide no fewer than three hinges for each door more than 42 inches high.
- F. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant. Suitable for user provided padlocks.
1. Multipoint Latching: Finger-lift latch control designed for use with User supplied padlocks; positive automatic latching.
 - a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
 - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact.
- G. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.
- H. Hooks: Manufacturer's standard ball-pointed hooks, aluminum or steel; zinc plated.
- I. Legs: 6 inches high; formed by extending vertical frame members, or fabricated from 0.075-inch nominal-thickness steel sheet; welded to bottom of locker.
1. Closed Front and End Bases: Fabricated from 0.036-inch nominal-thickness steel sheet.
- J. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.
- K. Filler Panels: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.
- L. Materials:
1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

- M. Configuration and sizes: As indicated on the Drawings.
- N. Finish: Baked enamel or powder coat.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.3 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 - 2. See drawings for locker configurations and sizes.
 - 3. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. Equipment: Provide each locker with an identification plate and the following equipment:
 - 1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- D. Knocked-Down Construction: Fabricate metal lockers by assembling at Project site, using manufacturer's nuts, bolts, screws, or rivets.
- E. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.
- F. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

2.4 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
 - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lockers level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
- B. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on door faces or face frames.
- C. Equipment:
 - 1. Attach hooks with at least two fasteners.
 - 2. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - 1. Attach recess trim to recessed metal lockers with concealed clips.
 - 2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.

3.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 113300 – RETRACTABLE STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. This Section includes manual, non-rated, metal retractable stairway including frame, and door.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for framed opening.

1.2 ACTION SUBMITTALS

A. Product Data: Preparation instructions, storage and handling requirements and installation methods.

B. Shop Drawings: For retractable stairs. Include plan, details, and sections showing sizes and connection to rough opening.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain retractable stairs through one source from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store retractable stairs under cover in manufacturer's unopened packaging. If stored outside, under a tarp and suitable cover.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Product: Subject to compliance with requirements, provide: Precision Ladders, LLC – Super Simplex Disappearing Stairway, Model 1000 (8'-0" ceiling height/10'-4 1/2" attic deck height – field verify).

1. Comply with ANSI A14.9: Safety Requirements for Ceiling Mounted Disappearing Climbing Systems, Commercial Type, for rough openings between 27 inches to 39 inches.
2. Stairway capacity: 500 lbs.

2.2 MATERIAL

A. Door: (non-fire rated)

1. 1/8" Aluminum sheet attached to stairway frame with a steel piano hinge. Door overlaps bottom flange of frame. Eye bolt accommodates pole for opening and closing door.

B. Stairway:

1. Stringers:

- a. 6005-T5 Extruded aluminum channel 5" x 1" x 1/8".
- b. Tri-fold design.
- c. Steel blade type hinges.
- d. Adjustable foot with plastic Mar-guard.
- e. Pitch 63° (standard), or as required.

2. Treads:

- a. 6005-T5 Extruded aluminum channel 5-3/16" x 1-1/4" x 1/8".
- b. Width 5-3/16".
- c. Length 21-9/16" (standard). Lengths to 36" available.
- d. Deeply serrated top surface.
- e. 9-1/2" riser height (standard).
- f. Clear tread width: 18" min.

C. Frame:

1. For greater than 12" from ceiling to roof deck, use a custom fabricated frame using 1/8" steel with factory-installed tread(s) to cover the distance from finished ceiling to finished floor above. Frame shall be on a 63° angle on the hinge end 90° on the other end, custom depth to fill distance from ceiling to floor above. The frame shall have pre-drilled and mounted brackets to allow for hanging from and fastening to the roof deck above.

D. Hardware:

1. Steel blade type hinge connecting stringer sections, zinc plated & chromate sealed, bolted to stringers.

2. Steel operating arms, zinc plated & chromate sealed, both sides.
3. Double acting steel springs and cable, both sides.
4. Rivets rating at 1100 lb. shear strength each.
5. Steel section alignment clips at stringer section joints.
6. Molder rubber guards at corners of aluminum door panel.

E. Safety:

1. Steel bar handrail riveted to stringers, upper section, right side standard.
2. Steel section alignment clips at stringer section joints.

F. Custom Size:

1. Floor to Floor Dimension: See Drawings.

G. Accessories:

1. Steel pole to aid opening and closing stairways.
2. Precision Fold assist to aid in folding and unfolding of stairs.

H. Fabrication:

1. Stairway shall be completely fabricated ready for installation before shipment to the site.

I. Finishes:

1. Mill finish on aluminum stairway components.
2. Prime coat on frame.

J. Source Quality Control:

1. All products tested in factory test jig for proper operation before shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine rough opening in ceiling for opening size and squareness.

3.2 INSTALLATION

- A. Install per manufacturer's installation instructions.

3.3 ADJUSTING

- A. Test door operation after installation. Adjust or replace as required.
- B. Repair finished surfaces and clean surfaces primed for painting.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that retractable stairs operate as new.

END OF SECTION 113300

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated, single-roller shades.
2. Manually operated, double-roller shades.
3. Motor-operated, double-roller shades.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
2. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED, (AND DOUBLE) SINGLE-ROLLER SHADES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoSystems - MechoShade "UrbanShade" or comparable product by one of the following:
 - 1. Draper, Inc.
- B. Roller Shade Locations: Single roller shades as indicated on Drawings. Double roller shades at Room L245 only.
- C. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch

that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Clip, jamb mount.
 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.
- D. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: Right side of interior face of shade.
 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- F. Shadebands:
1. Shadeband Material: Light-filtering fabric.
 2. Shadeband Material: Light-blocking fabric at Rooms L163, L164, L165 doors, including transoms over doors only.
 - a. Room L245 manual double roller shade to have outside shade as light-blocking.
 3. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- G. Installation Accessories:
1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and

shadeband assembly when shade is fully open, but not less than 4 inches.

2. Endcap Covers: To cover exposed endcaps.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 MOTOR-OPERATED, DOUBLE-ROLLER SHADES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoSystems - MechoShade "UrbanShade" or comparable product by one of the following:
 1. Draper, Inc.
- B. Roller Shade Locations: As indicated on Drawings. Motor-operated, double roller shades to be located in Rooms L163, L164 and L165. Gang together operation of pairs of shades and transom shade in each room.
- C. Motorized Operating Systems: Provide factory-assembled, shade-operator systems of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Electric Motor: Manufacturer's standard tubular, enclosed in rollers.
 - a. Electrical Characteristics: Single phase, 110 V, 60 Hz.
 3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
 - a. Individual Switch Control Station: Maintained-contact, five-position, rocker-style, wall-switch-operated control station with open, close, and center off functions.
 4. Limit Switches: Adjustable switches, interlocked with motor controls and set to stop shade movement automatically at fully raised and fully lowered positions.
- D. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 1. Double-Roller Mounting Configuration: Offset, outside roller over and inside roller under.
 2. Inside Roller:

- a. Drive-End Location: Right side of interior face of shade.
 - b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 3. Outside Roller:
 - a. Drive-End Location: Right side of interior face of shade.
 - b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 4. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.
- F. Inside Shadebands:
 1. Shadeband Material: Light-filtering fabric.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- G. Outside Shadebands:
 1. Shadeband Material: Light-blocking fabric.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- H. Installation Accessories:
 1. Front and Rear Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches.
 2. Endcap Covers: To cover exposed endcaps.
 3. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
 4. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
 5. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Source: MechoSystems, Mecho EcoVeil Sheer 6750.
 - 2. Type: Shade cloths shall be woven of 0.010 in. or 0.018 in opaque, extruded vinyl coated polyester yarn consisting of polyester core yarn..
 - 3. Weave: Basketweave .
 - 4. Thickness: 0.030 inch.
 - 5. Roll Width: As indicated on the Drawings.
 - 6. Orientation on Shadeband: Up the bolt.
 - 7. Openness Factor: 5 percent.
 - 8. Color: As selected by Architect from manufacturer's full range.
- C. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.
 - 1. Source: MechoShade, Mecho Ecoveil Sheer 1750.
 - 2. Type: Fiberglass textile with PVC film bonded to both sides consisting of approximately 75% reinforced vinyl and 25% fiberglass yarn.
 - 3. Thickness: 0.030 inch.
 - 4. Roll Width: As indicated on the Drawings.
 - 5. Orientation on Shadeband: Up the bolt.
 - 6. Features: Washable.
 - 7. Color: As selected by Architect from manufacturer's full range.

2.5 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
 - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than

1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass.
- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 142400 - HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Hydraulic elevators.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for temporary use of elevators for construction purposes.
 - 2. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
 - 3. Section 042000 "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
 - 4. Section 051200 "Structural Steel Framing" for the following:
 - a. Attachment plates, angle brackets, and other structural-steel preparations for fastening guide-rail brackets.
 - b. Divider beams.
 - c. Hoist beams.
 - d. Structural-steel shapes for subsills that are part of steel frame.
 - 5. Section 055000 "Metal Fabrications" for the following:
 - a. Pit ladders.
 - 6. Section 09 6813 "Tile Carpeting" for finish flooring in elevator cars.
 - 7. Section 221429 "Sump Pumps" for sump pumps, sumps, and sump covers in elevator pits.
 - 8. Electrical Drawings for communications pathways and rough-ins to the controller.
 - 9. Electrical Drawings for detectors for elevator recall.
 - 10. Civil Drawings and specification notes for excavating well hole to accommodate cylinder assembly and for the disposition of excavated material from the cylinder well hole.

1.2 DEFINITIONS

- A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.
- B. Service Elevator: A passenger elevator that is also used to carry freight.

1.3 ACTION SUBMITTALS

- A. Product Data: Hydraulic elevators.
- B. Product Data Submittals: Include capacities, sizes, performances, operations, safety

features, finishes, and similar information. Include product data for car enclosures; hoistway entrances; and operation, control, and signal systems.

- C. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing; machine room layout; coordination with building structure; relationships with other construction; and locations of equipment.
 - 2. Include large-scale layout of car-control station and standby-power operation control panel.
 - 3. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands.
- D. Samples for Initial Selection: For finishes involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by elevator manufacturer, certifying that hoistway, pit, and machine room layout and dimensions, as indicated on Drawings, and electrical service including standby-power generator, as indicated and specified, are adequate for elevator system being provided.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
 - 1. Submit manufacturer's/installer's standard operation and maintenance manual, in accordance with ASME A17.1/CSA B44 including diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under

cover, and in a dry location.

1.8 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Furnish well casing and coordinate delivery with related excavation work.
- C. Coordinate locations and dimensions of other work specified in other Sections that relates to hydraulic elevators, including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.9 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 HYDRAULIC ELEVATORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide OTIS Worldwide Corp.; HydorFit 4510R or comparable product by one of the following:
 - 1. Schindler Elevator Corp
 - 2. ThyssenKrupp Elevator
- B. Source Limitations: Obtain elevators from single manufacturer.
 - 1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, are manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Standard: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines, and, ICC A117.1.

2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components are used, as included in standard elevator systems and as required for complete system.
- B. Elevator Description:
 - 1. Type:
 - Holeless, beside-the-car, telescoping, dual cylinder.
 - 2. Rated Load: 4500 lb.
 - 3. Freight Loading Class for Service Elevators: Class A.
 - 4. Rated Speed: 100 fpm.
 - 5. Operation System: Single automatic operation.
 - 6. Auxiliary Operations:
 - a. Standby-power operation.
 - b. Standby-powered lowering.
 - c. Automatic dispatching of loaded car.
 - d. Nuisance call cancel.
 - e. Loaded-car bypass.
 - 7. Security Features: Car-to-lobby feature.
 - 8. Car Enclosures:
 - a. Inside Width: Not less than, 5'-5 9/16" from side wall to side wall.
 - b. Inside Depth: Not less than, 7'-11 1/2" from back wall to front wall (return panels).
 - c. Inside Height: Not less than 93 inches to underside of ceiling.
 - d. Front Walls (Return Panels): Satin stainless steel, ASTM A480/A480M, No. 4 finish with integral car door frames.
 - e. Car Fixtures: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
 - f. Side and Rear Wall Panels: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
 - g. Reveals: Black Enameled .
 - h. Door Faces (Interior): Satin stainless steel, ASTM A480/A480M, No. 4 finish.
 - i. Door Sills: Aluminum.
 - j. Ceiling: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
 - k. Handrails: 1-1/2 inches round, at sides of car.
 - l. Floor prepared to receive resilient flooring (specified in Section 096500 "Resilient Flooring").

9. Hoistway Entrances:
 - a. Width: 48 inches.
 - b. Height: 84 inches.
 - c. Type: Two-speed side sliding opening.
 - d. Frames: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
 - e. Doors and Transoms: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
 - f. Sills: Aluminum.
 - g. Sills at Other Floors: Aluminum.
10. Hall Fixtures: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
11. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, ASTM A480/A480M, No. 4 finish.
 - b. Provide hooks for protective pads in all cars and one complete set(s) of full-height protective pads.

2.4 OPERATION SYSTEMS

- A. Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.
- B. Auxiliary Operations:
 1. Single-Car Standby-Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby. Manual operation causes automatic operation to cease.
 2. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors start closing.
 3. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
- C. Security Features: Security features do not affect emergency firefighters' service.
 1. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.

2.5 DOOR-REOPENING DEVICES

- A. Infrared Array: Provide door-reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance.

Interruption of one or more light beams causes doors to stop and reopen.

2.6 SIGNAL EQUIPMENT

- A. Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal-resistant buttons and lighted elements illuminated with LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
 - 1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
 - 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 284621.11 "Addressable Fire-Alarm Systems."
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- F. Hall Push-Button Stations: Provide one hall push-button station at each landing.
 - 1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - 2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
- G. Hall Lanterns: Units with illuminated arrows; however, provide single arrow at terminal landings. Provide the following:
 - 1. Manufacturer's standard wall-mounted units.
- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
- I. Standby-Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed. For each elevator, provide illuminated signals that indicate when they are operational and when they are at the designated emergency return level with doors open.
- J. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated

emergency return level with doors open. Provide standby-power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

- K. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.7 FINISH MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.
- C. Stainless Steel Sheet: ASTM A240/A240M, Type 304.
- D. Stainless Steel Bars: ASTM A276/A276M, Type 304.
- E. Stainless Steel Tubing: ASTM A554, Grade MT 304.
- F. Bronze Tubing: ASTM B135/B135M, Alloy UNS No. C23000 (red brass, 85 percent copper).
- G. Aluminum Extrusions: ASTM B221, Alloy 6063.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF HYDRAULIC ELEVATORS

- A. Excavation for Cylinder: Drill well hole in elevator pit to accommodate installation of cylinder; comply with applicable requirements in Section 312000 "Earth Moving."
- B. Provide waterproof well casing as necessary to retain well-hole walls.
- C. Install cylinder in protective casing within well hole. Before installing protective casing, remove water and debris from well hole and provide permanent waterproof seal at bottom of well casing.
 - 1. Fill void space between protective casing and cylinder with corrosion-protective filler.
 - 2. Align cylinder and fill space around protective casing with fine sand.

- D. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between protective casing and pit floor with 4 inches of nonshrink, nonmetallic grout.
- E. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
- F. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.
- G. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- H. Install piping above the floor, where possible. Install underground piping in casing.
 - 1. Excavate for piping and backfill encased piping according to applicable requirements in Section 312000 "Earth Moving."
- I. Lubricate operating parts of systems as recommended by manufacturers.
- J. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- K. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.
- L. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- M. Locate hall signal equipment for elevators as follows unless otherwise indicated:
 - 1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
 - 2. Place hall lanterns either above or beside each hoistway entrance.
 - 3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

- A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator(s).
- B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service includes 12 months' full maintenance by skilled employees of elevator Installer.
 1. Maintenance service consisting of regular examinations and adjustments of the elevator equipment shall be provided by the elevator Installer. This service shall not be subcontracted but shall be performed by the elevator Installer. All work shall be performed by competent employees during regular working hours of regular working days. This service shall not cover adjustments, repairs, or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator Installer. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.
 2. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies are manufacturer's authorized replacement parts and supplies.
 3. Perform emergency callback service during normal working hours with response time of two hours or less.

END OF SECTION 142400

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DIVISION 21 FIRE SUPPRESSION

21 0000 General Requirements for Fire Suppression Systems

- 21 0001 Basic Fire Suppression Requirements
- 21 0002 Fire Suppression Work in Existing Buildings
- 21 0004 Firestopping for Fire Suppression Systems
- 21 0005 Excavation, Backfill and Surface Restoration

21 0500 Common Work Results for Fire Suppression

- 21 0513 Electrical Requirements for Fire Suppression Equipment
- 21 0519 Meters and Gauges
- 21 0529 Pipe Hangers and Supports
- 21 0553 Identification for Fire Suppression Systems

21 1000 Water Based Fire Suppression Systems

- 21 1313 Wet-Pipe Sprinkler Systems
- 21 1316 Dry-Pipe Sprinkler Systems

21 2000 Clean-Agent Fire Extinguishing Systems

- 21 2213 Clean-Agent Fire Extinguishing Systems

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SECTION 21 0001 – BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the following:
1. General Requirements
 2. Definitions
 3. Scope of Work
 4. Drawings and Specifications
 5. Reference Standards
 6. Allowances, Unit Prices and Alternates
 7. Site Visit
 8. Permits and Regulations
 9. Project Management and Coordination
 10. Workmanship
 11. Protection
 12. Painting
 13. Cleaning
 14. Equipment Selection
 15. Shop Drawings
 16. Final Inspection and Punch List
 17. Operation and Maintenance Manuals
 18. Record Drawings
 19. Warranties
 20. Project Closeout
 21. Operation and Adjustment of Equipment
 22. Operating Demonstration and Instruction

1.2 GENERAL REQUIREMENTS

- A. All provisions of Division 00 Front End Documents and Division 01 General Requirements apply to work specified in this Division.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this Fire Suppression work.
- C. A complete and functional Fire Suppression system installation shall be provided under this Division. Should overlap of work among trades become evident, this shall be called to the attention of the architect. In such event, none of the trades or their suppliers shall assume that he relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

- D. The Fire Suppression, Plumbing, HVAC and Electrical drawings and specifications assign work (labor and/or materials) to be provided by the General, Fire Suppression, Plumbing, HVAC or Electrical Contractor or their sub-contractors. Understanding that the contractors for mechanical and electrical work are sub-contractors to the (General) Contractor, such assignments are not intended to restrict the General Contractor in assignment of work among the sub-contractor to accommodate trade agreements and practices or the normal conduct of the construction work.

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 SCOPE OF WORK

- A. The scope of the Fire Suppression work includes furnishing, installing, testing and warranty of all Fire Suppression work shown on the Fire Suppression drawings and specified herein, including Division 00, division 01, Division 21 and applicable provisions of other relevant Divisions.

1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word “proved,” as used, shall mean “furnish and install.” If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.
- B. Make all necessary field measurements to insure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset

which may be necessary to complete the systems. Having pipe and fittings fabricated and delivered in advance of making actual measurements shall be sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.

- D. The Architect shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties.
- E. Equipment, or piping shall not be installed or run above electrical switchgear or panelboards, nor in or above the access space in the immediate vicinity of the electrical switchgear/panelboards, in accordance with NEC Article 384.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect's decision shall be final in regard to the arrangement of ductwork, piping, etc., where conflict arises.
- G. Provides offsets in system runs, additional fittings, necessary drains and minor valves, traps, and devices required to complete the installation, or for the proper operation of the system. Each Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.6 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ADTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.7 ALLOWANCES, UNIT PRICES AND ALTERNATES

- A. Refer to Sections 012100 Allowances, 012200 Unit Prices and 012300 Alternates.

1.8 SITE VISIT

- A. Refer to Sections 017300 Execution.
- B. Each bidder shall visit the project site to understand the existing conditions and compare the conditions with information shown on the drawings. Report immediately to the Architect any

issues or discrepancies which are discovered that affect the bid. Changes to contract price will not be considered for site condition issues that are readily apparent from a thorough site review.

1.9 PERMITS, REGULATIONS AND INSPECTION

- A. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.
- B. The fire suppression contractor shall be responsible to prepare a permit set of documents to file for and obtain all required permits from the governing inspection agencies. Include payment of all permit and inspection fees applicable to the work in this Division.
- C. All work shall be subject to inspection and approval of Federal, State and local agencies as may be appropriate as well as the Architect and Engineer.
- D. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.10 PROJECT MANAGEMENT AND COORDINATION

- A. Refer to Section 013100 Project Management and Coordination.
- B. The HVAC Contractor shall initially prepare and be responsible for ¼" scale coordination drawings. These drawings shall be reproduced and distributed to the Fire Suppression, Plumbing and Electrical Contractors for their input and revisions. Work together with all contractors to obtain finish coordinated drawings. No work shall be installed until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Engineer.

1.11 WORKMANSHIP

- A. Refer to Section 014000 Quality Requirements.
- B. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect shall have the right to stop the work if highest quality workmanship is not maintained.
- C. Fire suppression design and work shall be performed by licensed Fire Suppression Contractors in accordance with requirements of the jurisdiction.

1.12 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from

theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.

- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide plastic sheeting, drop cloths or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.
- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of ducts, piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.13 PAINTING

- A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in Division 21:
 - 1. Ferrous metal which is no factory or shop painted or galvanized and which remains exposed to view in the finished areas of the building / building including finished areas, mechanical rooms, storage rooms, and other unfinished areas shall be given a prime coat of paint.
 - 2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint.
 - 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.
- B. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 09 Finishes. All rust must be removed before application of paint.
- C. Finish painting is included in the General Contract except where otherwise required under remodeling work.

1.14 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain. The contractor shall also clean duct interiors and interior components of new or existing air handling system equipment if dirt, dust or debris have generated in the course of work have accumulated on these surfaces.

1.15 EQUIPMENT SELECTION

- A. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 - 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specifications, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturers listed.
 - 2. Where the words “or approved equal: appear after a manufacturer’s name, specific approval must be obtained from the Architect during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
 - 3. Where the words “equal to” appear, followed by a manufacturer’s name and sometimes a model or series designation, such designation is intended to establish a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer’s approval.
- B. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- C. Before bidding equipment, and again in the preparation of shop drawings the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated piping and accessories. Also verify that adequate space is available for servicing of the equipment.

- D. If extensive changes in pipe, duct or equipment layout or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.16 SHOP DRAWINGS

- A. Refer to Section 01600 Product Requirements.
- B. One set of shop drawings, in electronic format (.pdf), with descriptive information shall be assembled by each Contractor of equipment and materials furnished in his contract and submitted to the Architect and/or Engineer for review as stated in Division 01. These shall be submitted as soon as practicable and before special equipment is manufactured and before installation.
- C. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.
- D. The review of shop drawings by the Architect or Engineer shall not relieve the Contactor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- E. Shop drawings for the following Fire Suppression equipment and materials shall be submitted :
 - 1. Pipe, fittings and joining methods for the various systems.
 - 2. Firestopping systems for pipe penetrations.
 - 3. Pipe hangers.
 - 4. Valves.
 - 5. Gauges.
 - 6. Sprinkler heads and accessories.
 - 7. Wet pipe and dry pipe components.
 - 8. Dry pipe and dry pipe components.
 - 9. Sprinkler system installation drawings per NFPA 13, applicable calculations and water supply flow curve.

1.17 FINAL INSPECION AND PUNCH LIST

- A. Refer to Section 017700 Closeout Procedures.

1.18 OPERATING AND MAINTENANCE MANUALS

- A. Refer to Section 017823 Operation and Maintenance Data.
- B. All shop drawing and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams, parts list and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. In addition, the

Contractor shall prepare a chart listing all items of equipment which are furnished under his contract and indicating the nature of maintenance required, the recommended frequency of checking these points and the type of lubricating media or replacement material required.

- C. These shall be assembled into three-ring loose lead binders or other appropriate binding. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to the Architect or Engineer for review. Upon approval, manuals shall be turned over to the Owner.

1.19 RECORD DRAWINGS

- A. Refer to Section 017839 Project Record Drawings.
- B. Each Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawing shall be turned over to the Architect.

1.20 WARRANTIES

- A. Refer to Section 017700 Closeout Procedures.
- B. This Contractor shall warrant all workmanship, equipment and material entering into this contact for a period of one year of date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect. Any materials or equipment proving to be defective during this warranty period shall be made good by this Contractor without expense to the Owner.
- C. This provision is intended specifically to cover deficiencies in contract completion or performance which are discovered after systems are placed in operation. Also included shall be supplementary assistance in adjusting or providing operating instructions as the need develops and replacing overload heater elements in starters where necessary to keep systems in operation. Heater element sizes shall not exceed the motor manufacturer's recommendations.
- D. This provision shall not be construed to include maintenance items such as replacing filters, re-tightening or repacking glands, greasing, oiling belt tightening and cleaning strainers after these have been done for final close-out.
- E. Provisions of this warranty shall be considered supplementary to warranty provisions under General Conditions.

1.21 PROJECT CLOSEOUT

- A. Refer to Section 017700 Closeout Procedures.

1.22 OPERATIONS AND ADJUSTMENT OF EQUIPMENT

- A. As the fire suppression systems are placed in operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing air and water systems,

adjusting fan speeds, belts, pulleys, tightening packing glands, and adjusting all operating equipment.

- B. Caution: Verify that all bearings are lubricated, all motors are operating in the right direction, and correct overload heater elements are provided on all motors. Do not depend wholly on the electrician's judgment in these matters. Follow specific instructions in regard to lubrication. Do not oil or grease presealed ball bearings unless upon manufacturer's specific instructions.
- C. Test relief valves, air vents and regulating valves to insure proper operation.

1.23 OPERATING DEMONSTRATION AND INSTRUCTIONS

- A. Refer to Section 017900 Demonstration and Training as well as individual Division 21 Sections for requirements.
- B. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.
- C. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- D. A minimum of 2 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:
 - 1. Show locations of items of equipment and their purpose.
 - 2. Review binder containing instructions and equipment and systems data.
 - 3. Coordinate written and verbal instructions so that personnel understand each.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION – NOT APPLICABLE

END OF SECTION 21 0001

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SECTION 21 0002 – FIRE SUPPRESSION WORK IN EXISTING BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the following:

1. General Requirements for Renovation Work
2. Inspection of Existing Building
3. Work Hours
4. Tobacco Products
5. Barriers and Signage
6. Storage of Tools and Materials
7. Protection of Existing Building and Equipment
8. Confined Spaces
9. Noise, Fumes and Dust Control
10. Soldering Welding and Cutting
11. Removals Disposal and Reuse
12. Draining, Flush and Refill of Piping Systems
13. Continuity of Systems
14. Cutting and Patching
15. Cleaning

1.2 GENERAL REQUIREMENTS FOR RENOVATION WORK

- A. Refer to Article 1 Specification requirements and notes on the drawings where provided for requirements related to renovation work.
- B. Meet with the Owner, Architect and Engineer before demolition or construction begins to establish procedures for work effort in the existing building. Provide names and phone numbers and establish emergency contact information where work is performed. Provide security information to the Owner for all personnel who will be working on site. Educate all construction personnel in regard to the project requirements and procedures.

- C. Coordinate effort with other contractors involved in the renovation project to minimize the disruption, system outages, phasing of work, share cleaning responsibilities, etc.

1.3 INSPECTION OF EXISTING BUILDING

- A. Each bidder shall inspect the project site and the existing building in the early time frame of the bidding period. Conditions shall be compared with information shown on the drawings. Report to the Architect/Engineer any significant discrepancies which may be discovered in a timely fashion so that direction may be provided in an addendum. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

1.4 WORK HOURS

- A. Work hours for construction shall be as defined in Section 01150- Project Phasing or other specification sections or drawing notes.
- B. Where allowed, contractors may work normal hours except after hours is required for operations that are noisy, generate obnoxious fumes or dust, require shut down of ventilation systems, etc. The Owner reserves the right to stop normal hour work where the Owner deems the effort to be disruptive to their ongoing operations.
- C. Any work that creates hazards in or requires closure of corridors, exit pathways or stairwells work in corridors must be performed after hours when the building is not occupied.
- D. All occupied areas, corridors exit pathways and stairwells must be left clean, lighted (including emergency egress and exit signage) usable and safe at the end of each work shift.
- E. Access to the work area shall be coordinated with the Owner; follow all security protocols for parking, sign in, key control, etc. established by the Owner.

1.5 TOBACCO PRODUCTS

- A. Smoking or chewing tobacco products are expressly prohibited to be used within the building and on the premises except where specifically permitted by the Owner or in construction company trailers or vehicles where permitted by the construction company.

PART 2 - PRODUCTS- NOT APPLICABLE

PART 3 - EXECUTION

3.1 BARRIERS AND SIGNAGE

- A. Barriers and signage shall be provided as appropriate to identify work areas and to prevent unauthorized entry by non construction personnel. Refer to appropriate Division 1 specification requirements and notes on the drawings where provided.
- B. All barriers and signs should be high visibility type and be maintained at all times.

3.2 STORAGE OF TOOLS AND MATERIALS

- A. Store all site material and tools in the active job site area, specific storage areas are not provided except where otherwise noted for material and tools. The contractor is responsible for security.
- B. Storage is specifically prohibited in means of egress paths and stairwells.

3.3 PROTECTION OF EXISTING BUILDING AND EQUIPMENT

- A. The Owners' property and the property of other contractors shall be respected at all times. Provide drop clothes, visqueen or other suitable barriers where dust and debris is generated. Tape ends of barriers for sealing purposes.
- B. Provide 55 gallon drums or smaller buckets as appropriate and use funnels, hoses, etc. where draining liquid systems.
- C. Provide plywood sheets for protection of walls, floors or Owner equipment or systems that are remaining in place near demolition or new installation work where there is possible damage from heavy material or equipment.

3.4 CONFINED SPACES

- A. Notify the Owner when performing work in confined spaces. Provide a written procedure for approval and obtain approval from the Owner when so requested.
- B. All work in confined spaces shall be done in accordance with OSHA regulations.

3.5 NOISE FUME AND DUST CONTROL

- A. Provide barriers and ventilation as required to limit the effect from construction generated noise fume and dust control on spaces that continue to be occupied by the Owner. Refer to protection of building and equipment paragraph above. In addition to the basic protection, provide additional visqueen barriers to limit airborne migration of dust and fumes. Provide supplemental portable fans to exhaust air to the outside of the building where appropriate. Use of the Owners' ventilation systems to induce positive or negative pressure is prohibited unless authorized by the Owner. Shut off ventilation systems serving the area where use of these systems can induce fumes or dust into return or exhaust ducts. Where systems need to remain operational for occupied areas, arrange to temporarily shutoff portions of the system in the work area. Provide taped visqueen covers on HVAC air supply and exhaust devices to limit migration. Coordinate all efforts requiring modification or shutdown of ventilation systems with the Owner. Contractor shut down of these systems is prohibited without Owner permission.
- B. Arrange with the Owner when required to shutoff fire alarm or smoke detectors to perform work. With the Owners' prior approval. Cover smoke detectors where needed to prevent false alarms due to generated dust or fumes. Minimize outages and coordinate efforts to limit the effect due to false alarms.
- C. Where significant dust or fume generating work, welding or cutting operations are required for removal or new work, provide fume removal equipment with telescoping arms to locally capture the fumes. Fume exhaust shall be directed outside or adequately filtered and recirculated.
- D. Areas shall be thoroughly ventilated after completion of the work on a daily basis to remove residual odors and fumes before occupancy occurs the next day.
- E. Provide vacuum cleaners and other equipment to clean and restore conditions.

3.6 SOLDERING WELDING AND CUTTING

- A. For soldering, welding or cutting operations, provide insulated, fire rated barriers and blankets to isolate cover and protect remaining systems and materials, furniture, furnishings, floors, walls, ceilings, etc.
- B. Refer to noise, fume and dust control provisions in the previous paragraph.
- C. Obtain burn approval from the Owner before commencing any soldering or welding effort. Coordinate outages of fire alarm systems as noted in the previous paragraph.
- D. Provide a Fire Watch at each welding location. Fire Watch personnel shall be dedicated for the sole purpose of fire prevention during welding operations. All Fire Watch personnel shall be properly trained and equipped, including fire extinguisher, fire blanket and communication equipment for assistance request.
- E. Provide a fire extinguisher at every soldering or welding location.

3.7 REMOVALS DISPOSAL AND REUSE

- A. Refer to the drawings for the scope of remodeling in the existing building.
- B. Cooperate with the General Contractor regarding all removal and remodeling work. Each Contractor shall remove existing work which is associated with his trade and which will be superfluous when the new work is installed and made operational.
- C. Extraneous ductwork and piping which is or becomes accessible shall be removed and stubs shall be capped at the first active duct or pipe encountered. Ductwork and piping that is and remains inaccessible shall be abandoned. Ends of abandoned duct and pipe shall be capped so as to be concealed by finished surfaces. Upon completion of the work no abandoned duct. Pipe, valve or stub shall extend thru finished floors, walls or ceilings.
- D. When it is necessary to reroute a section of active ductwork or piping the rerouted section shall be installed before removing the existing in order to minimize system down time. Rerouted sections shall be insulated as required for new work. Patch insulation on existing ductwork and piping which has been damaged or removed in this work.
- E. Where existing piping is removed and holes are left in existing walls, finished ceilings, floors, etc., these holes shall be patched using materials to match the existing construction to restore and maintain the integrity of the existing partition.
- F. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where directed on the premises all removed material and equipment so designated by the Owner. All material and equipment which the Owner does not wish to retain shall become the property of the Contractor responsible for removal and shall be removed from the premises and properly disposed.
- G. Disposal of materials regulated by EPA shall be done in strict accordance with latest requirements. Provide documentation to the Owner that disposal was properly executed.
- H. Remove, store and reinstall lay-in ceiling tile and grid as needed to perform work in areas where such removal and re-installation is not to be done by the General Contractor. Damaged tile and/or grid shall be replaced with new matching tile and/or grid.
- I. In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with Owner. Protect the Owner's property by providing dust covers and temporary plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.
- J. Refinish any surface disturbed under this work match existing, except where refinishing of that surface is included under the General Contract.

3.8 DRAINING FLUSHING AND REFILL OF PIPING SYSTEMS

- A. Existing liquid systems shall be drained as required before removal or connection of new piping extensions.
- B. Draining of the system shall be the responsibility of the contractor. Provide threaded connections, etc. to direct fluids to drainage points. Water systems may be drained to sanitary systems or where permitted, to storm systems. Verify any chemical treatment, inhibitors or freeze protection additives in the existing systems and obtain a permit from the local sewer authority before disposing.
- C. Provide drums or containers to accept other than water drainage and remove from the premises and properly dispose. Provide visqueen to protect Owners' property when opening pipes, even where piping has been drained to prevent damage from residual liquid that remains in the pipe.

3.9 CONTINUITY OF SYSTEMS

- A. Work shall be so planned and executed as to provide reasonably continuous services of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch-over, the Owner shall be notified in advance and outages scheduled at the Owner's reasonable convenience.
- B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline must include tentative dates, times of day for disruption, downtime and restoration services. Submit the outline sufficiently in advance of the proposed work to allow the Architect or Engineer to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.
- C. Shutdown of systems and work undertaken during shutdown shall be bid as being done outside of normal working hours.

3.10 CUTTING AND PATCHING

- A. Refer to Division 1 – General Requirements for information regarding cutting and patching.
- B. Plan the work well ahead of the general construction. Where pipes and ducts are to pass thru new walls, partitions, floors, roof or ceilings, place sleeves in these elements or arrange with the General Contractor to provide openings where sleeves are not practical. Where sleeves or openings have not been installed, cut holes and patch as required for the installation of this work, or pay other trades for doing this work when so directed by the Architect. Any damage caused to the building shall be repaired or rectified.
- C. Where pipes and ducts are to pass thru, above or behind existing walls, partitions, floors, roof or ceiling, cutting, patching and refinishing of same shall be included in this contract. Core drilling and saw cutting shall be utilized.

- D. All material, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Architect. Wall, floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.
- E. Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry wall where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck.

3.11 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Cleaning responsibility remains with the contractor creating the dust or debris unless noted otherwise in Division 1 specifications. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain.
- D. The contractor shall also clean duct interiors and interior components of new or existing air handling system equipment if dirt, dust or debris have generated in the course of work have accumulated on these surfaces.

END OF SECTION 21 0002

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SECTION 21 0004 – FIRESTOPPING FOR FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Firestopping materials shall be manufactured and/or supplied by:
1. Hilti, Inc.
 2. Johns Manville.
 3. Nelson Firestop Products.
 4. Specified Technologies Inc.
 5. 3M; Fire Protection Products Division.
 6. Tremco; Sealant/Weatherproofing Division.

2.2 FIRESTOPPING

- A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every pipe at penetration of all fire resistance rated walls and horizontal assemblies.
- D. Provide rigid supports for pipes on both sides of the fire resistance rated wall or assembly where required as part of the fire stop assembly.
- E. Coordinate opening size and additional framing requirement with the General Contractor for each opening to meet the firestop installation requirements.

END OF SECTION 21 0004

SECTION 21 0005 – EXCAVATION, BACKFILL AND SURFACE RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Excavating and backfilling for utility trenches.

1.2 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- E. Fill: Soil materials used to raise existing grades.
- F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below topsoil materials.
- H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1.4 GENERAL

- A. Excavate for all in-grade, under-floor piping, underground, exterior piping, and incidental work which are included in the Fire Suppression contract. Backfill to finish grade or to levels consistent with the General Contractor's and Site Contractor's activities. Cut existing drive and parking lot paving, walks, curbs and other permanent hard surfaces which are to be encountered. Repair or restore exterior surfaces to original condition where such are not affected by Division 2 – Site Work. Cut existing floor slabs and replace slabs in conformance to 22 0002.
- B. Excavation and trench wall supporting, cribbing, sloping and stepping of excavations required for safety shall be done in accordance with OSHA and local requirements. Pumping of water from excavations and trenches which may be required during construction shall be included in this contract.
- C. Contact the Ohio Utilities Protection Service (1-800-362-2764) well in advance of the start of any excavation to determine if any of the utility companies or departments have underground utilities in or near the project area.
- D. Contact local water and sewer departments, gas company, electric company, telephone company, etc., regarding the possibility of encountering existing utilities. The integrity of all existing utilities shall be respected.
- E. Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced by the Contractor to the full satisfaction of the utility owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Bedding Course: Naturally or artificially graded natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- B. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

PART 3 - EXECUTION

3.1 EXCAVATION FOR UTILITY TRENCHES

- A. Trenches for interior and exterior piping shall be over-excavated and the pipe shall be laid on 6" minimum depth sand bed.
- B. Backfilling of excavations and trenches inside the building and outside under paved or other hard surfaced areas, shall be with graded pea gravel, graded coarse sand or compacted, crushed limestone, 3/4" maximum size, to prevent undue settlement. Backfill material for plastic piping shall be pea gravel or sand. Other excavations and trenches shall be backfilled with similar materials up to 18" above the top of the piping. The remainder shall be with similar materials or with excavated material having no large clods, stones or rocks.
- C. Maintain in place adequate barricades, guards, planking, plating signage, warning lights, etc., at and around excavations.
- D. Backfill shall be mechanically compacted in layers not over 6" deep. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of as directed by the General Contractor. Refer to Division 31 Earthwork for compaction requirements.
- E. Concrete floor slabs, paving, sidewalks, curbs sodded and other finished surfaces which have been damaged or removed in order to install the underground work shall be replaced but this Contractor equal to original conditions. Refer to Division 32 for Surface Restoration requirements. This requirement is not applicable in areas where the General Contractor or the Site Contractor is obligated to provide new surfaces.
- F. Excavation, backfill, surface repair and traffic control within the public right-of-way shall be in accordance with governing agency rules and regulations. Any fee for activity in the roadways shall be included in this contract so that no additional cost will accrue to the Owner.
- G. All exterior underground piping shall be protected against future excavation damage by placing a plastic tape warning marker in each trench during backfill. Tape shall be 6' wide with black letters identifying the piping service. Tape shall be equal to that manufactured by Seton. Install tape full length of the trench approximately 18' above and on the centerline of the pipe.

END OF SECTION 21 0005

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SECTION 21 0513 - ELECTRICAL REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for electrical work for Fire Suppression equipment.

1.2 COORDINATION

- A. Refer to the Fire Suppression drawings and also the Electrical drawings for requirements related to each trade. Coordinate all aspects of electrical components and wiring to complete the systems.

1.3 QUALITY ASSURANCE

- A. Equipment, devices shall be designed, constructed and installed in accordance with applicable standards of NEMA and the National Electric Code. Equipment shall be tested and listed by UL or other approved agency and installed in accordance with all instructions included as part of such listing.
- B. Electrical equipment, devices, fuses, wire, conduit and methods shall comply with applicable provisions of Division 26 - Electrical.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All power wiring shall be run in conduit. Control wiring shall be run in conduit except where open wiring is permitted in other applicable specification sections.
- B. Fuses shall be furnished and installed in fuse clips of equipment and switches provided by the Fire Suppression Contractors.

END OF SECTION 21 0513

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SECTION 21 0519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gauges.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

- A. Pressure gauges, including compound gauges and vacuum gauges, shall be Bourdon tube type with 4-1/2" dial and cast aluminum case, equal to Trerice 600C Series. Accuracy shall be 1% at mid-range.
- B. Pressure gauges for low pressure application, calibrated in inches of water gauge, ounces per sq. in. or 0-5 psi, as appropriate, shall be equal to Trerice 860.
- C. Pressure gauges at pumps shall be liquid filled Bourdon tube type with 4" dial and stainless-steel case and internals, equal to Trerice 700 Series.
- D. A brass cock or bronze ball valve and a pressure snubber shall be furnished with each pressure gauge.
- E. Ranges of pressure gauges shall be selected to be consistent with anticipated pressures. Range shall be approximately twice the normal system working pressure at the gauge location.

2.2 TEST PLUGS

- A. Pressure-temperature test plugs for insertion of pressure gauge or thermometer shall be a brass fitting with neoprene or Nordel self-sealing insert and knurled brass cap with plastic capture tab. Fittings shall be equal to Peterson "PT". Furnish two thermometers and two pressure gauges with integral insertion stem appropriate for use with the test plugs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Pressure gauges shall be installed where shown on the drawings, where required by applicable codes.
- B. Gauges shall be positioned to be read with unobstructed view from the floor. Pressure-temperature test plugs shall be installed where shown, located in a position to be most readable.

END OF SECTION 21 0519

SECTION 21 0529 – PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Hanger Rods and Attachments.
 - 4. Pipe Riser Supports
 - 5. Base Mounted Pipe Supports
- B. See Specification Section 21 0516 "Expansion Fittings and Loops " for pipe guides and anchors.
- C. See Specification Section 21 Seismic Control for Fire Suppression Systems for seismic isolation devices.

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS

- A. Hangers and supports for piping shall be equal to the Anvil catalog numbers as follows:
 - 1. Pear shaped band hanger with adjustable swivel ring type per NFPA standards, lock nut and rod attachment, carbon steel with galvanized finish, Anvil fig. 69.

2.2 HANGER RODS AND ATTACHMENTS

- A. Hanger rods shall be solid steel, threaded-end or all-thread rod, of diameter listed below. A hanger attachment device (for attachment to the structure) and locking nut at the hanger attachment shall be provided on each hanger.

<u>Pipe Size</u>	<u>Min. Rod Dia.</u>
4" and smaller	3/8"
5" to 6"	1/2"

- B. Hanger rod attachment devices for attachment to the structure shall be:
1. Beam clamps for steel construction equal to Anvil Fig. 92, 93, or 94. Utilize swivel type in sloped steel construction to provide vertical support of pipe without bending hanger rods.
 2. Side beam bracket for wood construction equal to Anvil Fig. 206.
 3. Channel support system equal to Unistrut or Hilti.

2.3 PIPE RISER SUPPORTS

- A. Riser clamps shall be:
1. Carbon steel, epoxy coated or galvanized finish- Anvil Fig. 261.

2.4 BASE MOUNTED PIPE SUPPORTS

- A. Base mounted pipe supports shall be factory or shop prime coat painted equal to Anvil Fig. numbers as follows:
1. Adjustable pipe saddle support and yoke– Fig. 265.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Spacing of hangers shall be as follows:
1. Steel pipe - Vertical:
 - a. At the base and 15 ft. maximum spacing unless otherwise shown.
 2. Steel pipe - Horizontal:
 - a. 2" size and smaller – 8 ft. intervals
 - b. 2-1/2" thru 6" – 10 ft. intervals

3. Copper Tubing - Vertical
 - a. At the base and 10 ft. maximum spacing unless otherwise shown.
 4. Copper Tubing – Horizontal
 - a. 1-1/4” size and smaller – 6 ft. intervals
 - b. 1-1/2” thru 2” – 8 ft.. intervals
 - c. 2-1/2” and larger – 10 ft. intervals
- B. In piping systems with rolled or cut groove end pipe and mechanical joint couplings, pipe hangers shall be provided on horizontal piping at normal specified intervals and, in addition, so that no pipe shall be left unsupported between any two couplings nor left unsupported whenever a change in direction takes place. Added supports may be omitted on “rigid” couplings such as Victaulic Style 07 Zero-Flex. Vertical piping shall be supported at normal specified intervals or every other pipe length, which ever is more frequent. The base of the riser or base fitting shall be supported.
- C. Attachment of pipe hangers to the structure shall be with:
1. Provide anchoring where steel beam clamps are attached to sloping surfaces of beam flanges and where otherwise required to insure permanent attachment.
 2. Side beam bracket in wood construction, secured to the wood joist with lag screws set in drilled pilot holes.
 3. Attachment to steel deck is prohibited. Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical.
 4. Attachment to manufactured trusses and other engineered structural members and supports shall be done in strict accordance with the structural manufacturer’s recommendations. Refer to the architectural and structural drawings for type of engineered structural systems being used. Connections to these structural members shall be made with connection devices and methods approved by the structural manufacturer. Provide additional supports with supplemental steel shapes when spacing between structural members exceeds specified distances.
- D. Pipe hangers shall be adjusted to proper elevation and all hanger rods set in a vertical position.
- E. Extended legs of pipe riser clamps shall be shortened as needed to maintain concealment of the clamp within finished spaces. Insure that adequate support is still maintained.

END OF SECTION 21 0529

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SECTION 21 0553 - IDENTIFICATION FOR FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Warning markers.
4. Valve Tags

1.2 SUBMITTAL

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Labels, tags and markers shall comply with ANSI A13.1 for lettering size, colors and length of color field.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Each item or major equipment shall be labeled. This shall include dry-pipe valves and other similar equipment.
- B. Labeling shall be:
1. Permanently attached plastic laminated signs with 1" high lettering. Signs on exterior equipments shall be brass.

2.2 PIPE LABELS

- A. Pipe markings shall be applied to all piping.
- B. Labeling shall be:
1. Plastic semi-rigid snap-on type, manufacturer's standard pre-printed color coded pipe markers extending fully around the pipe and insulation or pressure-sensitive vinyl pipe markers similar to above.

2.3 WARNING MARKERS

- A. Underground line marker tape shall be permanent bright-colored, plastic with continuous identification lettering. Tape over service lines that cannot be detected by a metal detector shall be multi-ply with an aluminum foil core.

2.4 VALVE TAGS

- A. Each shutoff valve, other than at equipment, shall be identified with a stamped tag. Valves and tagging shall be scheduled, typewritten on 8-1/2" x 11" paper, tabulating valve number, piping system, abbreviation, location of valve (room or area) and service (e.g. – south wing reheat boxes).
- B. Valve tags shall be engraved plastic laminate with solid brass S hook. Tags shall be engraved with "F" for Fire Suppression and the designated number.

2.5 ACCEPTABLE MANUFACTURERS

- A. Labels, markings and tags shall be manufactured by W.H. Brady, Seton, Allen or Industrial Safety Supply.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification marking and tagging shall be applied after painting has been completed.
- B. Coordinate names, abbreviations and other designations used with corresponding designations shown, specified or scheduled on drawings. Verify with Owners' desired identification marking system.
- C. The Plumbing, Fire Suppression and HVAC Contractors shall coordinate labeling, marking and tagging to attain coordinated and consistent systems of identification.
- D. Equipment labeling shall consist of unit designation as shown on the drawings.
- E. Pipe markers shall be placed at 25 ft. centers in mechanical rooms and concealed spaces and at 50 ft. centers in other exposed locations.
- F. Refer to appropriate sections of this specification for installation of underground line marker tape.
- G. Valve tags shall be placed on each valve except those intended for isolation of individual items of equipment. Valve tag schedules shall be prepared as specified above.

END OF SECTION 21 0553

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

B. Related Sections:

1. Division 21 Section "Dry-Pipe Sprinkler Systems" for dry-pipe sprinkler piping.
2. Division 21 Section "Electric-Drive, Vertical-Turbine Fire Pumps" for fire pumps, pressure-maintenance pumps, and fire-pump controllers.

1.2 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.3 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Design sprinkler system(s), by a State certified designer, using performance requirements and design criteria indicated.
1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
- C. System shall conform to the requirements of NFPA 13 and OBC chapter 9 and other requirements of the authority having jurisdiction.
- D. Sprinkler system design shall be approved by authorities having jurisdiction.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Approved Sprinkler Piping Drawings and Calculations: Working plans and hydraulic calculations, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- C. Welding certificates.
- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- E. Field quality-control reports.
- F. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Design Responsibility: Preparation of working plans, calculations, and field test reports by a certified sprinkler designer.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- 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.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.

- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating: 175 psig.
3. Acceptable Manufacturers: Subject to compliance with requirements:
 - a. Anvil International, Inc.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Stockholm Valve and Fittings.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - f. Watts Water Technologies, Inc.

B. Check Valves 2 1/2" and larger:

1. Standard: UL 312.
2. Type: Swing check.
3. Body Material: Cast iron.
4. Disc Material: Bronze
5. End Connections: Flanged or grooved.

C. Check Valves 2" and smaller:

1. Standard: UL 312.
2. Type: Swing check.
3. Body Material: Bronze.
4. Disc Material: Composition faced
5. End Connections: Threaded.

D. OS&Y Gate Valves 2" and smaller:

1. Standard: UL 262.
2. Body Material: Bronze.
3. End Connections: Threaded.

E. OS&Y Gate Valves: 2 1/2" and larger

1. Standard: UL 262.
2. Body Material: Cast or ductile iron.
3. End Connections: Flanged or grooved.

F. Indicating-Type Butterfly Valves:

1. Standard: UL 1091.

2. Pressure Rating: 175 psig minimum.
3. Valves 2" and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
4. Valves 2-1/2" and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
5. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch] indicating device.

G. Trim and Drain Ball Valves:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Body Material: Bronze.
3. End Connections: Threaded.

2.3 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.
6. Acceptable manufacturers:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.

B. Alarm Valves:

1. Standard: UL 193.
2. Design: For horizontal or vertical installation.
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
4. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175 psig minimum.
3. Type: Automatic draining, ball check.
4. Size: 3/4".
5. End Connections: Threaded.

2.4 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. Standard: UL 405.
2. Type: Flush, for wall mounting.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Corrosion-resistant metal.
5. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
6. Caps: Brass, lugged type, with gasket and chain.
7. Escutcheon Plate: Rectangular, brass, wall type.
8. Outlet: With pipe threads.
9. Body Style: Horizontal.
10. Number of Inlets: Two.
11. Outlet Location: Bottom.
12. Escutcheon Plate Marking: Similar to " AUTO SPKR."
13. Finish: Polished chrome plated.
14. Outlet Size: 4".
15. Acceptable Manufacturers:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Guardian Fire Equipment, Inc.
 - c. Potter Roemer.

2.5 FIRE-DEPARTMENT CONNECTIONS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Elkhart Brass Mfg. Company, Inc.
2. Fire-End & Croker Corporation.
3. Guardian Fire Equipment, Inc.
4. Kidde Fire Fighting.
5. Potter Roemer.
6. Reliable Automatic Sprinkler Co., Inc.

B. Description: Freestanding, with cast-bronze body, 5" stortz inlet and matching local fire-department requirements. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high brass sleeve; and round escutcheon plate.

- C. Standard: UL 405.
- D. Connections: One 5" stortz inlet and one 4" outlet.
- E. Finish Including Sleeve: Rough chrome plated.
- F. Escutcheon Plate Marking: "AUTO SPKR."

2.6 SPRINKLER SPECIALTY PIPE FITTINGS

A. Flow Detection and Test Assemblies:

- 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
- 2. Pressure Rating: 175 psig .
- 3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
- 4. Size: Same as connected piping.
- 5. Inlet and Outlet: Threaded.
- 6. Acceptable Manufacturers
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.

B. Branch Line Testers:

- 1. Standard: UL 199.
- 2. Pressure Rating: 175 psig minimum.
- 3. Body Material: Brass.
- 4. Size: Same as connected piping.
- 5. Inlet: Threaded.
- 6. Drain Outlet: Threaded and capped.
- 7. Branch Outlet: Threaded, for sprinkler.
- 8. Acceptable Manufacturers:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Fire-End & Croker Corporation.
 - c. Potter Roemer.

C. Sprinkler Inspector's Test Fittings:

- 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
- 2. Pressure Rating: 175 psig.
- 3. Body Material: Cast- or ductile-iron housing with sight glass.
- 4. Size: Same as connected piping.
- 5. Inlet and Outlet: Threaded.
- 6. Acceptable Manufacturers:
 - a. Tyco Fire & Building Products LP.
 - b. Victaulic Company.

- c. Viking Corporation.

2.7 SPRINKLERS

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
3. Acceptable Manufacturers:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.

B. Automatic Sprinklers:

1. Early-Suppression Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Quick-response type with nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

C. Sprinkler Finishes:

1. Rough brass.
2. Chrome plated.
3. Painted.

D. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications.

1. Exposed Pendent Sprinklers: Chrome-plated steel, one piece, flat.
2. Concealed Sprinklers: White -plated steel, two piece, with 1-inch vertical adjustment and a flat cover plate.
3. Sidewall Mounting: Chrome -plated steel one piece, flat.

E. Sprinkler Guards:

1. Standard: UL 199.
2. Type: Wire cage with fastening device for attaching to sprinkler.

F. In spaces subject to freezing use dry pendent sprinklers.

G. Spare sprinklers. Furnish spare sprinklers and sprinkler wrench in accordance with the requirements of NFPA 25. spare sprinklers shall include each type and temperature rating in a proportional amount equal of those installed. Provide a wall mounted cabinet for sprinklers and wrench.

2.8 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Flow Indicators:
 - 1. Standard: UL 346.
 - 2. Water-Flow Detector: Electrically supervised.
 - 3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - 4. Type: Paddle operated.
 - 5. Pressure Rating: 250 psig.
 - 6. Design Installation: Horizontal or vertical.
 - 7. Manufacturers:
 - a. ADT Security Services, Inc.
 - b. McDonnell & Miller; ITT Industries.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
 - e. Viking Corporation.
 - f. Victaulic Company.
- C. Valve Supervisory Switches:
 - 1. Standard: UL 346.
 - 2. Type: Electrically supervised.
 - 3. Components: Single-pole, double-throw switch with normally closed contacts.
 - 4. Design: Signals that controlled valve is in other than fully open position.
 - 5. Manufacturers:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.

2.9 PIPE ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.10 SLEEVES

- A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping

3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Locate sprinkler piping in areas protected from freezing.
- C. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes 2" and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having 2-1/2" and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

- L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than 1/4" and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- M. Install escutcheons for penetrations of walls, ceilings, and floors.
- N. Fill sprinkler system piping with water.

3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- 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 pipes, tubes, and fittings before assembly.
- D. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- E. 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.
- F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated.
- G. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- H. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install backflow preventer in potable-water-supply sources.
- D. Specialty Valves:
 - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.5 SPRINKLER INSTALLATION

- A. Refer to the drawing for the locations of various types of sprinklers.
- B. Install sprinklers in suspended ceilings in center of acoustical ceiling panels or at the quarter points along the long axis for rectangular panels.
- C. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire-department connections. Location to be approved by local Fire Department.
- B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.7 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, and walls.
- B. Sleeves are not required for core-drilled holes in cast walls or floors.
- C. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- D. Install sleeves in new partitions, slabs, and walls as they are built.
- E. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."

- F. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- G. Seal space outside of sleeves in concrete slabs and walls with grout.
- H. 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 firestop materials and installations in Division 07 Section "Penetration Firestopping."

3.8 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Coordinate with fire-alarm tests. Operate as required.
 - 5. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Turn spare sprinklers, wrench and cabinet over to owner

3.10 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

END OF SECTION 211313

SECTION 211316 - DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

1.2 SYSTEM DESCRIPTIONS

- A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinkler(s) releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from sprinklers that are open.

1.3 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Sprinkler system design shall be approved by authorities having jurisdiction.
1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 2. Sprinkler Occupancy Hazard Classifications:

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Approved Sprinkler Piping Drawings and Calculations: Working plans and hydraulic calculations, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

- D. Field quality-control reports.
- E. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

- 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Design Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

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. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

- 1. NFPA 13, "Installation of Sprinkler Systems."
- 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.

2.2 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

- 1. Valves shall be UL listed or FM approved.
- 2. Minimum Pressure Rating: 175 psig.
- 3. Acceptable Manufacturers: Subject to compliance with requirements:
 - a. Anvil International, Inc.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Stockholm Valve and Fittings.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - f. Watts Water Technologies, Inc.

B. Check Valves 2 1/2" and larger:

- 1. Standard: UL 312.
- 2. Type: Swing check.

3. Body Material: Cast iron.
 4. Disc Material: Bronze
 5. End Connections: Flanged or grooved.
- C. Check Valves 2" and smaller:
1. Standard: UL 312.
 2. Type: Swing check.
 3. Body Material: Bronze.
 4. Disc Material: Composition faced
 5. End Connections: Threaded.
- D. OS&Y Gate Valves 2" and smaller:
1. Standard: UL 262.
 2. Body Material: Bronze.
 3. End Connections: Threaded.
- E. OS&Y Gate Valves: 2 1/2" and larger
1. Standard: UL 262.
 2. Body Material: Cast or ductile iron.
 3. End Connections: Flanged or grooved.
- F. Indicating-Type Butterfly Valves:
1. Standard: UL 1091.
 2. Pressure Rating: 175 psig minimum.
 3. Valves 2" and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
 4. Valves 2-1/2" and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
 5. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch] indicating device.
- G. Trim and Drain Ball Valves:
1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 2. Body Material: Bronze.
 3. End Connections: Threaded.

2.3 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Dry-Pipe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.
2. Standard: UL 260
3. Design: Differential-pressure type.
4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
5. Air Compressor:
 - 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) Gast Manufacturing Inc.
 - 2) General Air Products, Inc,
 - 3) Viking Corporation.
 - b. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - c. Motor Horsepower: Fractional.
 - d. Power: 120-V ac, 60 Hz, single phase.

2.4 SPRINKLER SPECIALTY PIPE FITTINGS

A. Flow Detection and Test Assemblies:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig .

3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.
6. Acceptable Manufacturers
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.

B. Branch Line Testers:

1. Standard: UL 199.
2. Pressure Rating: 175 psig minimum.
3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.
8. Acceptable Manufacturers:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Fire-End & Croker Corporation.
 - c. Potter Roemer.

C. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.
6. Acceptable Manufacturers:
 - a. Tyco Fire & Building Products LP.
 - b. Victaulic Company.

2.5 SPRINKLERS

2.6 SPRINKLERS

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
3. Acceptable Manufacturers:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.

e. Viking Corporation.

B. Automatic Sprinklers:

1. Early-Suppression Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Quick-response type with nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

C. Sprinkler Finishes:

1. Rough brass.
2. Chrome plated.
3. Painted.

D. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications.

1. Exposed Pendent Sprinklers: Chrome-plated steel, one piece, flat.
2. Concealed Sprinklers: White -plated steel, two piece, with 1-inch vertical adjustment and a flat cover plate.
3. Sidewall Mounting: Chrome -plated steel one piece, flat.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.
5. Manufacturers:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.

2.8 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated finish with concealed hinge and set-screw.

C. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.9 SLEEVES

- A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building.
- B. Install shutoff valve, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements in NFPA 13 for installation of sprinkler piping.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes 2" and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having 2-1/2" and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install alarm devices in piping systems.
- I. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13 for hanger materials.

- J. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gauges to permit removal and install where they will not be subject to freezing.
- K. Drain dry-pipe sprinkler piping.
- L. Pressurize and check dry-pipe sprinkler system piping and air compressors.

3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes 2" and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having 2-1/2" and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. 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.
- H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Specialty Valves:
 - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - 2. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - a. Install air compressor and compressed-air supply piping.

3.5 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in the center of narrow dimension of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.6 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, and walls.
- B. Sleeves are not required for core-drilled holes in cast walls or floors.
- C. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- D. Install sleeves in new partitions, slabs, and walls as they are built.
- E. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- F. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- G. Seal space outside of sleeves in concrete slabs and walls with grout.
- H. 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 firestop materials and installations in Division 07 Section "Penetration Firestopping."

3.7 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Start and run air compressors.
 - 6. Coordinate with fire-alarm tests. Operate as required.
 - 7. Coordinate with fire-pump tests. Operate as required.
 - 8. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

END OF SECTION 21 1316

SECTION 21 2213 - CLEAN-AGENT FIRE EXTINGUISHING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes clean agent extinguishing systems with a detection and release system. Including:
1. Piping and piping specialties.
 2. Extinguishing-agent containers.
 3. Extinguishing agent.
 4. Detection and alarm devices.
 5. Releasing control panel.
 6. Accessories.
 7. Connection devices for and wiring between system components.
 8. Connection devices for power and integration into building's fire-alarm system.
- B. Section Excludes:
1. Power supply (120/240 VAC) to system control panel.
 2. Interface (conduit and wiring) to HVAC units, dampers, electric power supplies, relays, or shunt-trip breakers.
 3. Interface (conduit and wiring) to local fire alarm system
 4. Room sealing, other than penetrations made by the suppression system contractor during system installation. Suppression system contractor shall coordinate room sealing requirements with project's General contractor and all sub-contractors.

1.2 SYSTEM DESCRIPTION

- A. Double Interlocked clean-agent fire-extinguishing system shall be an engineered system for total flooding of the hazard area including the room cavity below the ceiling and below the raised floor. Provide two separate detection systems are used to detect fire activity. Detection of fire activity from both systems is required to trigger a release of agent.

1.3 STANDARDS AND CODES

- A. The design, equipment, installation, testing and maintenance of the Clean Agent Suppression System shall be in accordance with the applicable requirements set forth in the latest edition of the following codes and standards:
1. National Fire Protection Association (NFPA) Standards:
 - a. NFPA 2001 Clean Agent Fire Extinguishing Systems
 - b. NFPA 70 National Electric Code
 - c. NFPA 72 National Fire Alarm Code
 2. Factory Mutual Systems (FM) Publications

3. Factory Mutual Approval Guide
 4. Underwriters Laboratories, Inc. (UL) Publication
 5. National Electrical Manufacturers Association (NEMA) Publication "Enclosures for Industrial Controls and Systems"
 6. U.S. Environmental Protection Agency, Protection of Stratospheric Ozone 59 FR 13044 (SNAP)
 7. Requirements of the State and Local codes in force at time of award of contract.
- B. The standards listed, as well as all other applicable codes, standards, and good engineering practices, shall be used as "minimum" design standards.

1.4 PERFORMANCE REQUIREMENTS

- A. The system shall be a clean agent system as defined in NFPA 2001.
- B. The system shall provide a minimum design concentration as recommended by NFPA 2001 and the agent manufacturer, at the minimum anticipated temperature within the protected area. System design shall be equipped with provisions for room evacuation before agent release.
- C. The system shall be complete in all ways. It shall include a mechanical and electrical installation, all detection and control equipment, agent storage containers agent, discharge nozzles, pipe and fittings, manual release and abort stations, audible and visual alarm devices, auxiliary devices and controls, shutdowns, alarm interface, advisory signs, functional checkout and testing, training and any other operations necessary for a functional UL listed clean agent suppression system.
- D. Provide two (2) inspections during the first year of service: Inspections shall be made at 6-month intervals commencing when the system is first placed into normal service.
- E. The general contractor shall be responsible for sealing and securing the protected spaces against agent loss and/or leakage during the 10-minute "hold" period.
- F. Detectors shall be Cross-Zoned detection requiring two detectors to be in alarm before release.
- G. Automatic operation of each protected area shall be as follows:
1. Actuation of one (1) detector, within the system, shall:
 - a. Illuminate the "ALARM" lamp on the control panel face.
 - b. Energize an alarm bell.
 - c. Transfer auxiliary contacts, which can perform auxiliary system functions such as;; Transmit a signal to a fire alarm system; Shutdown HVAC equipment.
 - d. Light an individual lamp on an optional annunciator.
 2. Actuation of a 2nd detector, within the system, shall:
 - a. Illuminate the "PRE-DISCHARGE" lamp on the control panel face.
 - b. Energize pre-discharge horn/strobe devices.
 - c. Shut down the HVAC system and/or close dampers.
 - d. Start time-delay sequence (not to exceed 60 seconds).
 - e. System abort sequence is enabled at this time.
 - f. Light an individual lamp on an optional annunciator.

3. After completion of the time-delay sequence, the clean agent system shall discharge and the following shall occur:
 - a. Illuminate a "SYSTEM FIRED" lamp on the control panel face.
 - b. Energize a visual indicator(s) outside the hazard in which the discharge occurred.
 - c. Energize a "System Fired" audible device.
4. The system shall be capable of being actuated by manual discharge devices located at each hazard exit. Operation of a manual device shall duplicate the sequence description above except that the time delay and abort functions shall be bypassed. The manual discharge station shall be of the electrical actuation type and shall be supervised at the main control panel.

H. Manual stations shall immediately discharge extinguishing agent when activated.

I. Operating abort switches will delay extinguishing-agent discharge while being activated, and switches must be reset to prevent agent discharge. Release of hand pressure on the switch will cause agent discharge if the time delay has expired.

1.5 QUALITY ASSURANCE

A. MANUFACTURER

1. The manufacturer of the suppression system hardware and detection components shall be ISO 9001 registered.
2. The name of the manufacturer shall appear on all major components.
3. All devices, components, and equipment shall be the products of the same manufacturer, or supplied by the same manufacturer.
4. All devices, components, and equipment shall be new, standard products of the manufacturer's latest design and suitable to perform the functions intended.
5. All devices and equipment shall be UL listed and/or FM approved.
6. Locks for all cabinets shall be keyed alike.

B. INSTALLER

1. The installing contractor shall be trained by the supplier to design, install, test, and maintain fire suppression systems.
2. The installing contractor shall employ a NICET certified special hazard designer, Level II or above, who will be responsible for this project.
3. The installing contractor shall be an experienced firm regularly engaged in the installation of automatic clean agent, or similar, fire suppression systems, in strict accordance with all applicable codes and standards.
4. The installing contractor must have a minimum of five (5) years' experience in the design, installation, and testing, of clean agent, or similar fire suppression systems. A list of systems of a similar nature and scope shall be provided on request.
5. The installing contractor shall show evidence that his company carries a minimum \$2,000,000.00 liability and completed operations insurance policy. These limits shall supersede limits required in the general conditions of the specifications.
6. The installing contractor shall maintain, or have access to, a clean agent recharging station. The installing contractor shall provide proof of his ability to recharge the largest clean agent system within 24 hours after a discharge. Include the amount of bulk agent storage available.

7. The installing contractor shall be an authorized stocking distributor of the clean agent system equipment so that immediate replacement parts are available from inventory.
8. The installing contractor shall show proof of emergency service available on a twenty-four hour-seven day-a-week basis.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 SUBMITTALS

A. Product Data: For each product indicated.

B. Submit a preliminary equipment layout drawing to the owner for review.

C. The installing contractor shall submit the following design information and drawings for approval prior to starting work on this project:

1. Field installation layout drawings having a scale of not less than 1/8 in. = 1 ft.- 0 in. or 1:100 detailing the location of all agent storage tanks, nozzles, pipe runs, including pipe sizes and lengths, control panel(s), detectors, manual pull stations, abort stations, audible and visual alarms, etc.
2. Auxiliary details and information such as maintenance panels, door holders, special sealing requirements, and equipment shutdown.
3. Separate layouts, or drawings, shall be provided for each level, (i.e.; room, sub floor, and above ceiling) and for mechanical and electrical work.
4. Electrical layout drawings shall show the location of all devices and include point-to-point conduit runs and a description of the method(s) used for detector mounting.
5. Provide an internal control panel wiring diagram which shall include power supply requirements and field wiring termination points.
6. Separate drawing providing symbol legend and identifying all symbols used.
7. Annunciator wiring schematics and dimensioned display panel illustration shall be provided. (Optional device.)
8. Complete hydraulic flow calculations, from a UL listed computer program, shall be provided for all engineered clean agent systems. Calculation sheet(s) must include the manufacturer's name and UL listing number for verification. The individual sections of pipe and each fitting to be used, as shown on the isometrics, must be identified and included in the calculation. Total agent discharge time must be shown and detailed by zone.
9. Provide calculations for the battery stand-by power supply, taking into consideration the power requirements of all alarms, initiating devices, and auxiliary components under full load conditions.
10. A complete sequence of operation shall be submitted detailing all alarm devices, shutdown functions, remote signaling, damper operation, time delay, and agent discharge for each zone or system.

D. Once the preliminary layout is approved, submit drawings, calculations and system component sheets prepared according to NFPA 2001 for approval to the local fire prevention agency, owner's insurance underwriter, and all other authorities having jurisdiction before starting installation. Submit approved plans to the architect/engineer for record.

- E. Field quality-control test reports.
- F. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. GENERAL REQUIREMENTS

1. The clean agent system materials and equipment shall be standard products of the supplier's latest design and suitable to perform all functions intended. When one or more pieces of equipment must perform the same function(s), they shall be duplicates produced by one manufacturer.
2. All devices and equipment shall be U.L. Listed and/or FM approved.
3. Each system shall have its own supply of clean agent.
4. The system design can be modular, central storage, or a combination of both design criteria.
5. Systems shall be designed in accordance with the manufacturer's guidelines.
6. Each supply shall be located within the hazard area, or as near as possible, to reduce the amount of pipe and fittings required to install the system.
7. The clean agent shall be stored in. pressurized storage tanks. Tanks shall be of high-strength low alloy steel construction and conforming to NFPA 2001.
8. Tanks (master) shall be actuated by either a resettable electric actuator or by pneumatic means from a nitrogen cartridge located in the releasing device. Explosive devices shall not be permitted.
9. Each tank shall have a pressure gauge and low pressure switch (optional) to provide visual and electrical supervision of the container pressure. The low-pressure switch shall be wired to the control panel to provide audible and visual "Trouble" alarms in the event the container pressure drops below 290 psi (20 bar). The pressure gauge shall be color coded to provide an easy, visual indication of container pressure.
10. Tanks shall have a pressure relief provision that automatically operates before the internal nominal pressure exceeds 730 psi (50 bar).
11. Engineered discharge nozzles shall be provided within the manufacturer's guidelines to distribute the agent throughout the protected spaces. The nozzles shall be designed to provide proper agent quantity and distribution. Nozzles shall be available in ½ in. through 2 in. pipe sizes. Each size shall be available in 180° and 360° distribution patterns.
12. Distribution piping and fittings shall be installed in accordance with the manufacturer's requirements, NFPA, and approved piping standards and guidelines. All distribution piping shall be installed by qualified individuals using accepted practices and quality procedures.

2.2 AGENT

- A. Agent shall physical and chemical properties shall conform to the requirements of NFPA 2001.
- B. The agent shall be stored in pressurized containers. Container pressure shall not exceed 360 psig at 70 degrees F.

- C. The agent shall have the following characteristics:
 - 1. Ozone depletion potential of zero
 - 2. Atmospheric lifetime less than 50 years.

2.3 EXTINGUISHING-AGENT CONTAINERS

- A. Description: Steel tanks complying with ASME Boiler and Pressure Vessel Code: Section VIII, for unfired pressure vessels. Include minimum working-pressure rating that matches system charging pressure, valve, pressure switch, and pressure gage.
 - 1. Finish. Manufacturer's standard color, enamel or epoxy paint.
 - 2. Manifold: Fabricate with valves, pressure switches, and connections for multiple storage containers, as indicated.
 - 3. Manifold: Fabricate with valves, pressure switches, selector switch, and connections for main- and reserve-supply banks of multiple storage containers.
 - 4. Storage-Tank Brackets: Factory- or field-fabricated retaining brackets consisting of steel straps and channels; suitable for container support, maintenance, and tank refilling or replacement.

2.4 CONTROL PANEL

- A. The detection control system and its components shall be UL listed and FM approved for use as a local fire alarm system with releasing device service.
- B. The control system shall perform all functions necessary to operate the system detection, actuation, and auxiliary functions.
- C. The control system shall include battery standby power to support 24 hours in standby and 5 minutes in alarm.
- D. The control system shall be microprocessor based, utilizing a distributed processing concept. A single microprocessor failure shall not impact operation of additional modules in the system.
- E. The control system shall be capable of supporting Cross Zoned Detection.
- F. The control system shall supply integrated 2.0 amp (minimum) power supply circuitry.
- G. Each control system shall contain four (4) initiating circuits:
 - 1. a) Each circuit shall be capable of Class A (Style D) or Class B (Style A) operation.
 - 2. b) Each circuit shall be capable of operating up to fifteen (15) approved detectors or thirty (30) detectors per system.
 - 3. c) Each circuit shall be capable of monitoring contact devices configured for manual release, manual alarm, system abort, trouble input or auxiliary (non-fire) input.
- H. Each control system shall contain release circuits for activation of a fire suppression system(s):
 - 1. a) Each circuit shall be capable of Class B (Style Y) operation.
 - 2. b) Each circuit shall be rated for a minimum of 1.5 amp @ 24 VDC.

- I. Each control system shall contain two (2) indicating appliance circuits for annunciation:
 - 1. a) Each circuit shall be capable of Class A (Style B) or Class B (Style Y) operation.
 - 2. b) Each circuit shall be rated for a minimum of 1.5 amp @ 24 VDC.
- J. Each control system shall provide an auxiliary power supply rated for 2 amps @ 24 VDC.
- K. Each control system shall provide four (4) SPST relays: one for common alarm, one for common trouble, one for HVAC damper control, and one to shut down the air conditioning unit.. Coordinate relays carefully with other trades. Provide additional relays as required for proper system function.

2.5 DETECTORS

- A. The detectors shall be spaced and installed in accordance with the manufacturer's specifications and the guidelines of NFPA 72 and include the following types:
 - 1. Ionization Detectors: Comply with UL 268, dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
 - 2. Photoelectric Detectors: Comply with UL 268, consisting of LED light source and silicon photodiode receiving element.

2.6 MANUAL RELEASE (Electric)

- A. The electric manual release shall be a dual action device which provides a means of manually discharging the suppression system when used in conjunction with the detection system.
- B. The manual release shall be yellow so as not to be confused with building fire alarm pull stations.
- C. The manual release shall be provided with a Lexan cover. The cover shall be provided with a local alarm when the cover is lifted.
- D. The manual release or manual pull station shall be a dual action device requiring two distinct operations to initiate a system actuation.
- E. Manual actuation shall bypass the time delay and abort functions and shall cause all release and shutdown devices to operate in the same manner as if the system had operated automatically.
- F. Manual release shall be located at each exit from the protected hazard.

2.7 ABORT STATION

- A. The abort station shall be the "Dead Man" type and shall be located next to each manual release.
- B. The abort station shall be supervised and shall indicate a trouble condition at the control panel, if depressed, and no alarm condition exists.
- C. "Locking" or "Keyed" abort stations shall not be permitted.

2.8 AUDIBLE and VISUAL ALARMS

- A. Alarm audible and visual signal devices shall operate from the control panel.
- B. The strobe devices shall be amber, so as not to be confused with the building fire alarm system.
- C. A strobe device shall be placed outside, and above, each exit door from the protected space. Provide an advisory sign at each light location.

2.9 CAUTION AND ADVISORY SIGNS

- A. Signs shall be provided to comply with NFPA and the recommendations of the equipment provider.
 - 1. Entrance sign: (1) required at each entrance to a protected space.
 - 2. Manual discharge sign: (1) required at each manual release station.
 - 3. Flashing light sign: (1) required at each flashing light over each exit from a protected space.

2.10 SYSTEM AND CONTROL WIRING

- A. All system wiring shall be furnished and installed by the contractor.
- B. All wiring shall be installed in electrical metallic tubing (EMT), or conduit, and must be installed and kept separate from all other building wiring. Follow Division 26 requirements for conduit and box identification.
- C. All system components shall be securely supported independent of the wiring. Runs of conduit and wiring shall be straight, neatly arranged, properly supported, and installed parallel and perpendicular to walls and partitions.
- D. The sizes of the conductors shall be those specified by the manufacturer. Color-coded wire shall be used. All wires shall be tagged at all junction points and shall be free from shorts, earth connections (unless so noted on the system drawings), and crosses between conductors. Final terminations between the control panel and the system field wiring shall be made under the direct supervision of a factory-trained representative.
- E. All wiring shall be installed by qualified individuals, in a neat and workmanlike manner, to conform to the National Electrical Code, Article 725 and Article 760, except as otherwise permitted for limited energy circuits, as described in NFPA 72. Wiring installation shall meet all local, state, province, and/or country codes.
- F. The complete system electrical installation and all auxiliary components shall be connected to earth ground in accordance with the National Electrical Code.

2.11 PIPING MATERIALS

- A. Piping, Valves, and Discharge Nozzles: Comply with types and standards listed in NFPA 2001, Section "Distribution," for charging pressure of system.

2.12 PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type S, Grade B or ASTM A 106, Grade B; Schedule 40, , seamless steel pipe.
 - 1. Threaded Fittings:
 - a. Malleable-Iron Fittings: ASME B16.3, Class 300.
 - b. Flanges and Flanged Fittings: ASME B16.5, Class 300.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Steel, Keyed Couplings: UL 213, AWWA C606, approved or listed for clean-agent service, and matching steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gasket, and steel bolts and nuts.

2.13 VALVES

- A. General: Brass; suitable for intended operation.
- B. Container Valves: With rupture disc or solenoid and manual-release lever, capable of immediate and total agent discharge and suitable for intended flow capacity.
- C. Valves in Sections of Closed Piping and Manifolds: Fabricate to prevent entrapment of liquid, or install valve and separate pressure relief device.
- D. Valves in Manifolds: Check valve; installed to prevent loss of extinguishing agent when container is removed from manifold.

2.14 DISCHARGE NOZZLES

- A. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, discharge pattern, and capacity required for application.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Distribution piping and fittings shall be installed in accordance with the manufacturer's requirements, NFPA, and approved piping standards and guidelines. All distribution piping shall be installed by qualified individuals using accepted practices and quality procedures. All piping shall be adequately supported and anchored at all directional changes and nozzle locations.
1. All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish and cutting oils before assembly.
 2. All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male thread only..

3.2 Connect electrical devices to control panel and to building's fire alarm system.

3.3 Install signs at entry doors for protected areas to warn occupants that they are entering a room protected with a clean-agent fire extinguishing system.

3.4 Install signs at entry doors to advise persons outside the room the meaning of the horn(s), bell(s), and strobe light(s) outside the protected space.

3.5 SYSTEM INSPECTION AND CHECKOUT

- A. After the system installation has been completed, the entire system shall be checked out, inspected, and functionally tested by qualified, trained personnel, in accordance with the manufacturer's recommended procedures and NFPA standards.
1. All containers and distribution piping shall be checked for proper mounting and installation.
 2. All electrical wiring shall be tested for proper connection, continuity and resistance to earth.
 3. The complete system shall be functionally tested, in the presence of the owner or his representative, and all functions, including system and equipment interlocks, must be operational at least five (5) days prior to the final acceptance tests.
 4. Each detector shall be tested in accordance with the manufacturer's recommended procedures and test values recorded.
 5. All system and equipment interlocks, such as door release devices, audible and visual devices, equipment shutdowns, local and remote alarms, etc. shall function as required and designed.
 6. Each control panel circuit shall be tested for trouble by inducing a trouble condition into the system.

3.6 TRAINING REQUIREMENTS

- A. Prior to final acceptance, the installing contractor shall provide operational training to each shift of the owner's personnel. Each training session shall include control panel operation, manual and (optional) abort functions, trouble procedures, supervisory procedures, auxiliary functions and emergency procedures.

3.7 OPERATION and MAINTENANCE

- A. Prior to final acceptance, the installing contractor shall provide four (4) complete operation and maintenance instruction manuals to the owner. All aspects of system operation and maintenance shall be detailed, including piping isometrics, wiring diagrams of all circuits, a written description of the system design, sequence of operation and drawing(s) illustrating control logic and equipment used in the system. Checklists and procedures for emergency situations, troubleshooting techniques, maintenance operations and procedures shall be included in the manual.

3.8 AS-BUILT DRAWINGS

- A. Upon completion of each system, the installing contractor shall provide four (4) copies of system "AS-Built" drawings to the owner. The drawings shall show actual installation details including all equipment locations (ie., control panel(s), agent container(s), detectors, alarms, manual pull station(s) and abort switch(s), etc.), as well as piping and conduit routing details. Show all room or facilities modifications, including door and/or damper installations completed. One (1) copy of reproducible engineering drawings shall be provided reflecting all actual installation details.

3.9 ACCEPTANCE TEST

- A. At the time "AS-Built" drawings and maintenance/operations manuals are submitted, the installing contractor shall submit a "Test Plan" describing procedures to be used to test the control system(s). The Test Plan shall include a step-by-step description of all tests to be performed and shall indicate the type and location of test apparatus to be employed. The tests shall demonstrate that the operational and installation requirements of this specification have been met. All tests shall be conducted in the presence of the owner and shall not be conducted until the Test Plan has been approved.
- B. The tests shall demonstrate that the entire control system functions as designed and intended. All circuits shall be tested: automatic actuation and manual actuation, HVAC and power shutdowns, audible and visual alarm devices, and manual override of abort functions. Supervision of all panel circuits, including AC power and battery power supplies, shall be tested and qualified.
- C. A room pressurization test shall be conducted in each protected space to determine the presence of openings, which would affect the agent concentration levels. The test(s) shall be conducted using the Retro-Tec Corp. Door Fan system, or equivalent, with integrated computer program. All testing shall be in accordance with NFPA 2001.

- D. If room pressurization testing indicates that openings exist which would result in leaks and/or loss of the extinguishing agent, the installing contractor shall be responsible for coordinating the proper sealing of the protected space(s) by the general contractor or his sub-contractor or agent. The general contractor shall be responsible for adequately sealing all protected space(s) against agent loss or leakage. The installing contractor shall inspect all work to ascertain that the protected space(s) have been adequately and properly sealed. **THE SUPPRESSION SYSTEM INSTALLING CONTRACTOR SHALL BE RESPONSIBLE FOR THE SUCCESS OF THE ROOM PRESSURIZATION TESTS.** If the first room pressurization test is not successful, in accordance with these specifications, the installing contractor shall direct the general contractor to determine, and correct, the cause of the test failure. The installing contractor shall conduct additional room pressurization tests, at no additional cost to the owner, until a successful test is obtained. Copies of successful test results shall be submitted to the owner for his record.
- E. Upon acceptance by the owner, the completed system(s) shall be placed into service.

3.10 SYSTEM INSPECTIONS

- A. During the one-year warranty period, the installing contractor shall provide two (2) inspections of each system installed under this contract. The first inspection shall be at the six-month interval, and the second inspection at the 12-month interval. Inspections shall be conducted in accordance with the manufacturer's guidelines and the recommendations of NFPA 2001.
- B. Documents certifying satisfactory system(s) inspection shall be submitted to the owner upon completion of each inspection.

3.11 WARRANTY

- A. All system components furnished and installed under this contract shall be warranted against defects in design, materials and workmanship for the full warranty period which is standard with the manufacturer, but in no case less than one (1) year from the date of system acceptance.

3.12 FIELD QUALITY CONTROL

- A. Test and inspect clean-agent extinguishing system according to NFPA 2001, Section "Approval of Installations."
- B. Perform field-acceptance tests of each clean-agent extinguishing system according to NFPA 2001 when installation is complete. Perform system testing only after hazard-area enclosure construction has been completed and openings sealed.
- C. Correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be corrected or does not perform as specified and indicated, then retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- D. Remove and replace malfunctioning units and retest as specified above.

- E. Report test results promptly and in writing to Owner's representative and authorities having jurisdiction.

END OF SECTION 21 2213

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DIVISION 22 PLUMBING

22 0000 General Requirements for Plumbing Systems

- 22 0001 Basic Plumbing Requirements
- 22 0002 Plumbing Work in Existing Buildings
- 22 0004 Firestopping for Plumbing Systems
- 22 0005 Excavation, Backfill and Surface Restoration

22 0500 Common Work Results for Plumbing

- 22 0513 Electrical Requirements for Plumbing Equipment
- 22 0519 Meters and Gauges
- 22 0520 Common Piping Materials and Methods
- 22 0523 General Duty Valves
- 22 0529 Pipe Hangers and Supports
- 22 0530 Equipment Bases and Supports
- 22 0553 Identification for Plumbing Systems

22 0700 Plumbing Insulation

- 22 0719 Pipe Insulation

22 1000 Plumbing Piping and Pumps

- 22 1116 Domestic Water Piping
- 22 1119 Domestic Water Piping Specialties
- 22 1123 Domestic Water Pumps
- 22 1316 Sanitary Waste and Vent Piping
- 22 1319 Sanitary Waste Piping Specialties
- 22 1429 Sump Pumps
- 22 1613 – Natural Gas House Piping

22 3000 Plumbing Equipment

- 22 3333 Electric Storage Water Heaters

224000 Plumbing Fixtures

- 22 4200 Plumbing Fixtures

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SECTION 22 0001 – BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the following:
1. General Requirements
 2. Definitions
 3. Scope of Work
 4. Drawings and Specifications
 5. Reference Standards
 6. Allowances, Unit Prices and Alternates
 7. Site Visit
 8. Permits, Regulations and Inspections
 9. Project Management and Coordination
 10. Temporary Utilities
 11. Workmanship
 12. Protection
 13. Painting
 14. Cleaning
 15. Miscellaneous Equipment Connections
 16. Equipment Selection
 17. Shop Drawings
 18. Final Inspection and Punch List
 19. Operation and Maintenance Manuals
 20. Record Drawings
 21. Warranties
 22. Project Closeout
 23. Operation and Adjustment of Equipment
 24. Operating Demonstration and Instruction

1.2 GENERAL REQUIREMENTS

- A. All provisions of Division 00 Front End Documents and Division 01 General Requirements apply to work specified in this Division.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this Plumbing work.
- C. A complete and functional Plumbing system installation shall be provided under this Division. Should overlap of work among trades become evident, this shall be called to the attention of the architect. In such an event, none of the trades or their suppliers shall assume that he relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

- D. The Mechanical and Electrical drawings and specifications assign work (labor and/or materials to be provided by the General, Plumbing, Fire Suppression, HVAC or Electrical Contractor or their sub-contractors. Understanding that the contractors for mechanical and electrical work are sub-contractors to the (General) Contractor, such assignments are not intended to restrict the Contractor in assignment of work among the sub-contractor to accommodate trade agreements and practices or the normal conduct of the construction work.

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 SCOPE OF WORK

- A. The scope of the Plumbing work includes furnishing, installing, testing and warranty of all Plumbing work shown on the Plumbing drawings and specified herein, including Division 00, Division 01, Division 22 and applicable provisions of other relevant Divisions..

1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word “provide,” as used, shall mean “furnish and install.” If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.
- B. Make all necessary field measurements to insure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having pipe and fittings fabricated and delivered in advance of making actual measurements shall be sufficiently in advance as to

not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.

- D. The Architect shall reserve the right to make minor adjustments in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance so as not to cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties.
- E. Equipment or piping shall not be installed or run above electrical switchgear or panelboards, nor in or above the access space in the immediate vicinity of the electrical switchgear/panelboards, in accordance with NEC Article 384.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect's decision shall be final in regard to the arrangement of ductwork, piping, etc., where conflict arises.
- G. Provides offsets in system runs, additional fittings, necessary drains and minor valves, traps, and devices required to complete the installation, or for the proper operation of the system. Each Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such an event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.6 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ADTM, UL, ASPE, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.7 ALLOWANCES, UNIT PRICES AND ALTERNATES

- A. Refer to Sections 01200 Allowances, 012200 Unit Prices and 012300 Alternates.

1.8 SITE VISIT

- A. Refer to Section 017300 Execution.
- B. Each bidder shall visit the project site to understand the existing conditions and compare the conditions with information shown on the drawings. Report immediately to the Architect any issues or discrepancies which are discovered that affect the bid. Changes to contract price will not be considered for site condition issues that are readily apparent from a thorough site review.

1.9 PERMITS, REGULATIONS, AND INSPECTION

- A. Work must conform to applicable local, state, and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.
- B. Except where the permit application is made by the Architect or the Engineer, the Plumbing contractor shall be responsible to file for and obtain all required permits from the governing inspection agencies for the plumbing work. Where the Architect or Engineer is the Architect or Engineer of record, they will furnish sealed and signed drawings and specifications required by the permit authorities.
- C. Include payment of all permit and inspection fees applicable to the work in this Division.
- D. All work shall be subject to inspection and approval of Federal, State, and local agencies as may be appropriate as well as the Architect and Engineer.
- E. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.10 PROJECT MANAGEMENT AND COORDINATION

- A. Refer to Section 013100 Project Management and Coordination.
- B. The HVAC Contractor shall initially prepare and be responsible for ¼” scale coordination drawings. These drawings shall be reproduced and distributed to the Plumbing, Fire Suppression and Electrical Contractors for their input and revisions. Assure that all contractors work together to obtain finish coordinated drawings and no work being installed until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Engineer.

1.11 TEMPORARY UTILITIES

- A. Refer to Section 015000 – Temporary Facilities and Controls for division of responsibilities for temporary utilities.
- B. Each Contractor requiring water for construction purposes shall connect to wall hydrants or other connection points within the existing building.

1.12 WORKMANSHIP

- A. Refer to Section 014000 Quality Requirements.
- B. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect shall have the right to stop the work if highest quality workmanship is not maintained.

- C. Plumbing work shall be performed by licensed Plumbing Contractors in accordance with the requirements of the jurisdiction.

1.13 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide plastic sheeting, drop cloths or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. The Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.
- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.14 PAINTING

- A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in Division 22:
 - 1. Ferrous metal which is no factory or shop painted or galvanized and which remains exposed to view in the finished areas of the building / building including finished areas, mechanical rooms, storage rooms, and other unfinished areas shall be given a prime coat of paint.
 - 2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint.
 - 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.

- B. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 9 of the Specifications. All rust must be removed before application of paint.
- C. Finish painting is included in the General Contract except where otherwise required under remodeling work. Refer to the Cutting and Patching paragraph in this Section for finishing requirements

1.15 RECORD DRAWINGS

- A. Refer to Section 017839 Project Record drawings.
- B. Each Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawings shall be turned over to the Architect.

1.16 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain.

1.17 MISCELLANEOUS EQUIPMENT CONNECTIONS

- A. Certain categories of fixtures and equipment, including kitchen equipment, sterilizers, washers, laundry and laboratory equipment, require piping connections and duct connections as shown on the drawings. Equipment will be furnished and set in places by the equipment supplier.
- B. Make all final connections to these fixture and equipment, as indicated and in accordance with the manufacturer's recommendations. All piping connections shall be valved and final connections made with unions.
- C. Fixtures and equipment, unless otherwise noted, will be furnished complete with the basic plumbing supply and waste trim. The trim will generally be furnished "loose" and shall be installed under this work. Countertop sinks furnished "loose" shall also be installed by the Plumbing Contractor.
- D. Provide supplies, supply stops, traps, shut-off valves, fixture drains, continuous wastes and indirect wastes. Provide a water-hammer arrestor on the system side of each automatic (quick-closing) valve on water supply lines. Items not specifically described elsewhere in these

specifications shall be of the same manufacturer as similar items specified in conjunction with the plumbing fixtures.

- E. Roughing-in drawings shall be obtained for the various fixtures and items of equipment as the time approaches when such information is required; allow a reasonable period, from the time of notice to obtain this information.
- F. Connections to equipment shall be in accordance with manufacturers' installation guidelines. Any additional accessories recommended by the manufacturer such as gauges, shut-off valves, unions at connection points, etc., shall be provided by this Contractor.

1.18 EQUIPMENT SELECTION

- A. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- B. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 - 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specifications, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturer's listed.
 - 2. Where the words "or approved equal: appear after a manufacturer's name, specific approval must be obtained from the Architect during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
 - 3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.
- C. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- D. Before bidding equipment, and again in the preparation of shop drawings the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated piping and accessories. Also verify that adequate space is available for servicing of the equipment.
- E. If extensive changes in pipe, or equipment layout or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.19 SHOP DRAWINGS

- A. Refer to Section 016000 Product Requirements.
- B. One set of shop drawings, in electronic format (.pdf), with descriptive information shall be assembled by each Contractor of equipment and materials furnished in his contract and submitted to the Architect and/or Engineer for review as stated in Division 01. These shall be submitted as soon as practicable and before special equipment is manufactured and before installation.
- C. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified the same as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.
- D. The review of shop drawings by the Architect or Engineer shall not relieve the Contactor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- E. Shop drawings for the following Plumbing equipment and materials shall be submitted:
 - 1. Pipe, fittings and joining methods for the various systems.
 - 2. Firestopping systems for pipe penetrations.
 - 3. Pipe hangers and saddles.
 - 4. Valves.
 - 5. Gauges.
 - 6. Pipe insulation
 - 7. Supply system specialties.
 - 8. Backflow preventers
 - 9. Drainage system specialties
 - 10. Plumbing fixtures and trim
 - 11. Sump pumps, basin and controls
 - 12. Water heating equipment
 - 13. Dental gases equipment and accessories
 - 14. Dental vacuum equipment and accessories

1.20 OPERATING AND MAINTENANCE MANUALS

- A. Refer to Section 017823 Operation and Maintenance Data.
- B. All shop drawing and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams, parts list and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. In addition, the Contractor shall prepare a chart listing all items of equipment which are furnished under his contract and indicating the nature of maintenance required, the recommended frequency of checking these points and the type of lubricating media or replacement material required.
- C. These shall be assembled into three-ring loose lead binders or other appropriate bindings. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to

the Architect or Engineer for review. Upon approval, manuals shall be turned over to the Owner.

1.21 RECORD DRAWINGS

- A. Refer to Section 017839 Project Record Drawings.
- B. Each Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawings shall be turned over to the Architect.

1.22 WARRANTIES

- A. This Contractor shall warrant all workmanship, equipment and material entering into this contract for a period of one year of date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect. Any materials or equipment proving to be defective during this warranty period shall be made good by this Contractor without expense to the Owner.
- B. This provision is intended specifically to cover deficiencies in contract completion or performance which are discovered after systems are placed in operation. Also included shall be supplementary assistance in balancing, adjusting, or providing operating instructions as the need develops, and replacing overload heater elements in starters where necessary to keep systems in operation. Heater element sizes shall not exceed the motor manufacturer's recommendations.
- C. This provision shall not be construed to include maintenance items such as replacing filters, and cleaning strainers after these have been done for final close-out.
- D. The provisions of this warranty shall be considered supplementary to warranty provisions under General Conditions.

1.23 PROJECT CLOSEOUT

- A. Refer to Section 017700 Closeout Procedures.

1.24 OPERATIONS AND ADJUSTMENT OF EQUIPMENT

- A. As each piping system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing the domestic hot water return system,
- B. Caution: Verify that all bearings are lubricated, all motors are operating in the right direction, and correct overload heater elements are provided on all motors. Do not depend wholly on the electrician's judgment in these matters. Follow specific instructions in regard to lubrication. Do not oil or grease pre-sealed ball bearings unless upon manufacturer's specific instructions.
- C. Test relief valves, air vents and regulating valves to insure proper operation.

1.25 OPERATING DEMONSTRATION AND INSTRUCTIONS

- A. Refer to Section 017900 Demonstration and Training as well as individual Division 22 Sections for requirements.
- B. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.
- C. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- D. A minimum of 2 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:
 - 1. Show locations of items of equipment and their purpose.
 - 2. Review binder containing instructions and equipment and systems data.
 - 3. Coordinate written and verbal instructions so that personnel understand each.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION– NOT APPLICABLE

END OF SECTION 22 0001

SECTION 22 0002 – PLUMBING WORK IN EXISTING BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the following:
1. General Requirements for Renovation Work
 2. Inspection of Existing Building
 3. Work Hours
 4. Tobacco Products
 5. Barriers and Signage
 6. Storage of Tools and Materials
 7. Protection of Existing Building and Equipment
 8. Confined Spaces
 9. Noise, Fumes and Dust Control
 10. Soldering Welding and Cutting
 11. Removals Disposal and Reuse
 12. Draining, Flush and Refill of Piping Systems
 13. Continuity of Systems
 14. Cutting and Patching
 15. Cleaning

1.2 GENERAL REQUIREMENTS FOR RENOVATION WORK

- A. Refer to Article 1 Specification requirements and notes on the drawings where provided for requirements related to renovation work.
- B. Meet with the Owner, Architect and Engineer before demolition or construction begins to establish procedures for work effort in the existing building. Provide names and phone numbers and establish emergency contact information where work is performed. Provide security information requested by the Owner for all personnel who will be working on site. Educate all construction personnel in regard to the project requirements and procedures.
- C. Coordinate effort with other contractors involved in the renovation project to minimize the disruption, phasing of work, share cleaning responsibilities, etc.

1.3 INSPECTION OF EXISTING BUILDING

- A. Each bidder shall inspect the project site and the existing building in the early time frame of the bidding period. Conditions shall be compared with information shown on the drawings. Report to the Architect/Engineer any significant discrepancies which may be discovered in a timely

fashion so that direction may be provided in an addendum. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

1.4 WORK HOURS

- A. Work hours for construction shall be as defined in Section 01150- Project Phasing or other specification sections or drawing notes.
- B. Where allowed, contractors may work normal hours except after hours is required for operations that are noisy, generate obnoxious fumes or dust, require shut down of ventilation systems, etc. The Owner reserves the right to stop normal hour work where the Owner deems the effort to be disruptive to their ongoing operations.
- C. Any work that creates hazards in or requires closure of corridors, exit pathways or stairwells work in corridors must be performed after hours when the building is not occupied.
- D. All occupied areas, corridors exit pathways and stairwells must be left clean, lighted (including emergency egress and exit signage) usable and safe at the end of each work shift.
- E. Access to the work area shall be coordinated with the Owner; follow all security protocols for parking, sign in, key control, etc. established by the Owner.

1.5 TOBACCO PRODUCTS

- A. Smoking or chewing tobacco products are expressly prohibited to be used within the building and on the premises except where specifically permitted by the Owner or in construction company trailers or vehicles where permitted by the construction company.

PART 2 - PRODUCTS- NOT APPLICABLE

PART 3 - EXECUTION

3.1 BARRIERS AND SIGNAGE

- A. Barriers and signage shall be provided as appropriate to identify work areas and to prevent unauthorized entry by non construction personnel. Refer to appropriate Division 1 specification requirements and notes on the drawings where provided.
- B. All barriers and signs should be high visibility type and be maintained at all times.

3.2 STORAGE OF TOOLS AND MATERIALS

- A. Store all site material and tools in the active job site area, specific storage areas are not provided except where otherwise noted for material and tools. The contractor is responsible for security.
- B. Storage is specifically prohibited in means of egress paths and stairwells.

3.3 PROTECTION OF EXISTING BUILDING AND EQUIPMENT

- A. The Owners' property and the property of other contractors shall be respected at all times. Provide drop clothes, visqueen or other suitable barriers where dust and debris is generated. Tape ends of barriers for sealing purposes.
- B. Provide 55 gallon drums or smaller buckets as appropriate and use funnels where draining liquid systems.
- C. Provide plywood sheets for protection of walls, floors or Owner equipment or systems that are remaining in place near demolition or new installation work where there is possible damage from heavy material or equipment.

3.4 CONFINED SPACES

- A. Notify the Owner when performing work in confined spaces. Provide a written procedure for approval and obtain approval from the Owner when so requested.
- B. All work in confined spaces shall be done in accordance with OSHA regulations.

3.5 NOISE, FUME, AND DUST CONTROL

- A. Provide barriers and ventilation as required to limit the effect from construction generated noise fume and dust control on spaces that continue to be occupied by the Owner. Refer to protection of building and equipment paragraph above. In addition to the basic protection, provide additional visqueen barriers to limit airborne migration of dust and fumes. Provide supplemental portable fans to exhaust air to the outside of the building where appropriate. Use of the Owners' ventilation systems to induce positive or negative pressure is prohibited unless authorized by the Owner. Shut off ventilation systems serving the area where use of these systems can induce fumes or dust into return or exhaust ducts. Where systems need to remain operational for occupied areas, arrange to temporarily shutoff portions of the system in the work area. Provide taped visqueen covers on HVAC air supply and exhaust devices to limit migration. Coordinate all efforts requiring modification or shutdown of ventilation systems with the Owner. Contractor shut down of these systems is prohibited without Owner permission.
- B. Arrange with the Owner when required to shutoff fire alarm or smoke detectors to perform work. With the Owners' prior approval. Cover smoke detectors where needed to prevent false alarms due to work generated dust or fumes. Minimize outages and coordinate efforts to limit the effect due to false alarms.

FACILITY RENOVATION

- C. Where significant dust or fume generating work, welding or cutting operations are required for removal or new work, provide fume removal equipment with telescoping arms to locally capture the fumes. Fume exhaust shall be directed outside or adequately filtered and recirculated.
- D. Areas shall be thoroughly ventilated after completion of the work on a daily basis to remove residual odors and fumes before occupancy occurs the next day.
- E. Provide vacuum cleaners and other equipment to clean and restore conditions.

3.6 SOLDERING WELDING AND CUTTING

- A. For soldering, welding or cutting operations, provide insulated, fire rated barriers and blankets to isolate cover and protect remaining systems and materials, furniture, furnishings, floors, walls, ceilings, etc.
- B. Refer to noise, fume and dust control provisions in the previous paragraph.
- C. Obtain burn approval from the Owner before commencing any soldering or welding effort. Coordinate outages of fire alarm systems as noted in the previous paragraph.
- D. Provide a Fire Watch at each welding location. Fire Watch personnel shall be dedicated for the sole purpose of fire prevention during welding operations. All Fire Watch personnel shall be properly trained and equipped, including fire extinguisher, fire blanket and communication equipment for assistance request.
- E. Provide a fire extinguisher at every soldering or welding location.

3.7 REMOVALS, DISPOSAL, AND REUSE

- A. Refer to the drawings for the scope of remodeling in the existing building.
- B. Cooperate with the General Contractor regarding all removal and remodeling work. Each Contractor shall remove existing work which is associated with his trade and which will be superfluous when the new work is installed and made operational.
- C. Extraneous piping which is or becomes accessible shall be removed and stubs shall be capped at the first active pipe encountered. Piping that is and remains inaccessible shall be abandoned. Ends of abandoned pipe shall be capped so as to be concealed by finished surfaces. Upon completion of the work no abandoned duct. Pipe, valve or stub shall extend thru finished floors, walls or ceilings.
- D. When it is necessary to reroute a section of active piping the rerouted section shall be installed before removing the existing in order to minimize system down time. Rerouted sections shall be insulated as required for new work. Patch insulation on existing piping which has been damaged or removed in this work.

FACILITY RENOVATION

- E. Where existing piping is removed and holes are left in existing walls, finished ceilings, floors, etc., these holes shall be patched using materials to match the existing construction to restore and maintain the integrity of the existing partition.
- F. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where directed on the premises all removed material and equipment so designated by the Owner. All material and equipment which the Owner does not wish to retain shall become the property of the Contractor responsible for removal and shall be removed from the premises and properly disposed.
- G. Disposal of materials regulated by EPA shall be done in strict accordance with latest requirements. Provide documentation to the Owner that disposal was properly executed.
- H. Remove, store and reinstall lay-in ceiling tile and grid as needed to perform work in areas where such removal and re-installation is not to be done by the General Contractor. Damaged tile and/or grid shall be replaced with new matching tile and/or grid.
- I. In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with Owner. Protect the Owner's property by providing dust covers and temporary plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.
- J. Refinish any surface disturbed under this work match existing, except where refinishing of that surface is included under the General Contract.

3.8 DRAINING, FLUSHING, AND REFILL OF PIPING SYSTEMS

- A. Existing liquid systems shall be drained as required before removal or connection of new piping extensions.
- B. Draining the system shall be the responsibility of the contractor. Provide threaded connections, etc. to direct fluids to drainage points. Water systems may be drained to sanitary systems or where permitted, to storm systems. Verify any chemical treatment, inhibitors or freeze protection additives in the existing systems and obtain a permit from the local sewer authority before disposing.
- C. Provide drums or containers to accept other than water drainage and remove from the premises and properly dispose. Provide visqueen to protect Owners' property when opening pipes, even where piping has been drained to prevent damage from residual liquid that remains in the pipe.
- D. After new piping is connected and tested, flush clean and disinfect all existing piping that has been drained and new piping as specified in Section 22001, Basic Plumbing Requirements. Provide full port, 0.75" ball valves with hose connectors as described to facilitate flushing operations.

3.9 CONTINUITY OF SYSTEMS

- A. Work shall be so planned and executed as to provide reasonably continuous services of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch-over, the Owner shall be notified in advance and outages scheduled at the Owner's reasonable convenience.
- B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline must include tentative dates, times of day for disruption, downtime and restoration services. Submit the outline sufficiently in advance of the proposed work to allow the Architect or Engineer to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.
- C. Shutdown of system and work undertaken during shutdowns shall be bid as being done during normal working hours. If the Owner should require such work be performed outside of normal working hours, reimbursement shall be made for premium time expenses only.
- D. Shutdown of systems and work undertaken during shutdown shall be bid as being done outside of normal working hours.

3.10 CUTTING AND PATCHING

- A. Refer to Division 1 – General Requirements for information regarding cutting and patching.
- B. Plan the work well ahead of the general construction. Where pipes are to pass thru new walls, partitions, floors, roof or ceilings, place sleeves in these elements or arrange with the General Contractor to provide openings where sleeves are not practical. Where sleeves or openings have not been installed, cut holes and patch as required for the installation of this work, or pay other trades for doing this work when so directed by the Architect. Any damage caused to the building shall be repaired or rectified.
- C. Where pipes are to pass through, above, or behind existing walls, partitions, floors, roof or ceiling, cutting, patching and refinishing of same shall be included in this contract. Core drilling and saw cutting shall be utilized.
- D. All material, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Architect. Wall, floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.
- E. Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry wall where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck.

3.11 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain. The contractor shall also clean duct interiors and interior components of new or existing air handling system equipment if dirt, dust or debris have been generated in the course of work have accumulated on these surfaces.

END OF SECTION 22 0002

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SECTION 22 0004 – FIRESTOPPING FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestopping systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of

construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Firestopping materials shall be manufactured and/or supplied by:

1. Hilti, Inc.
2. Johns Manville.
3. Nelson Firestop Products.
4. Specified Technologies Inc.
5. 3M; Fire Protection Products Division.
6. Tremco; Sealant/Weatherproofing Division.

2.2 FIRESTOPPING

A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every pipe at penetration of all fire resistance rated walls and horizontal assemblies.
- D. Coordinate opening size and additional framing requirement with the General Contractor for each opening to meet the firestop installation requirements.

END OF SECTION 22 0004

SECTION 22 0005 – EXCAVATION, BACKFILL AND SURFACE RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Excavating and backfilling for utility trenches.
 - 2. Excavating and backfill for in ground tanks provided by Division 22.

1.2 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- E. Fill: Soil materials used to raise existing grades.
- F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below topsoil materials.
- H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1.4 GENERAL

- A. Excavate for all in-grade, under-floor piping, underground, exterior piping, underground tanks and incidental work which are included in the Plumbing contract. Backfill to finish grade or to levels consistent with the General Contractor's and Site Contractor's activities. Cut existing street, drive and parking lot paving, walks, curbs and other permanent hard surfaces which are to be encountered. Repair or restore exterior surfaces to original condition where such are not affected by Division 2 – Site Work. Cut existing floor slabs and replace slabs in conformance to 22 0002.
- B. Excavation and trench wall supporting, cribbing, sloping and stepping of excavations required for safety shall be done in accordance with OSHA and local requirements. Pumping of water from excavations and trenches which may be required during construction shall be included in this contract.
- C. Contact the Ohio Utilities Protection Service (1-800-362-2764) well in advance of the start of any excavation to determine if any of the utility companies or departments have underground utilities in or near the project area.
- D. Contact local water and sewer departments, gas company, electric company, telephone company, etc., regarding the possibility of encountering existing utilities. The integrity of all existing utilities shall be respected.
- E. Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced by the Contractor to the full satisfaction of the utility owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Bedding Course: Naturally or artificially graded natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- B. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

PART 3 - EXECUTION

3.1 EXCAVATION FOR UTILITY TRENCHES

- A. Trenches for interior and exterior piping shall be over-excavated and the pipe shall be laid on 6" minimum depth sand bed.
- B. Backfilling of excavations and trenches inside the building and outside under paved or other hard surfaced areas, shall be with graded pea gravel, graded coarse sand or compacted, crushed limestone, 3/4" maximum size, to prevent undue settlement. Backfill material for plastic piping shall be pea gravel or sand. Other excavations and trenches shall be backfilled with similar materials up to 18" above the top of the piping. The remainder shall be with similar materials or with excavated material having no large clods, stones or rocks.
- C. Maintain in place adequate barricades, guards, planking, plating signage, warning lights, etc., at and around excavations.
- D. Backfill shall be mechanically compacted in layers not over 6" deep. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of as directed by the General Contractor. Refer to Division 31 Earthwork for compaction requirements.
- E. Concrete floor slabs, paving, sidewalks, curbs sodded and other finished surfaces which have been damaged or removed in order to install the underground work shall be replaced but this Contractor equal to original conditions. Refer to Division 32 for Surface Restoration requirements. This requirement is not applicable in areas where the General Contractor or the Site Contractor is obligated to provide new surfaces.
- F. Excavation, backfill, surface repair and traffic control within the public right-of-way shall be in accordance with governing agency rules and regulations. Any fee for activity in the roadways shall be included in this contract so that no additional cost will accrue to the Owner.
- G. All exterior underground piping shall be protected against future excavation damage by placing a plastic tape warning marker in each trench during backfill. Tape shall be 6' wide with black letters identifying the piping service. Tape shall be equal to that manufactured by Seton. Install tape full length of the trench approximately 18' above and on the centerline of the pipe.

END OF SECTION 22 0005

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SECTION 22 0513 - ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for electrical work for Plumbing equipment including single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation and other electrical equipment, devices, fuses, wire, conduit and installation methods.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.
- B. Refer to the Plumbing drawings and also the Electrical drawings for requirements related to each trade. Coordinate all aspects of electrical components and wiring to complete the systems.

1.3 QUALITY ASSURANCE

- A. Equipment, devices shall be designed, constructed and installed in accordance with applicable standards of NEMA and the National Electric Code. Equipment shall be tested and listed by UL or other approved agency and installed in accordance with all instructions included as part of such listing.
- B. Electrical equipment, devices, fuses, wire, conduit and methods shall comply with applicable provisions of Division 26 - Electrical.

PART 2 - PRODUCTS

2.1 Motors

- A. General duty motors shall be induction type 1750 rpm NEMA Design "B" with copper windings, Class B or F insulation, and motor enclosure to suit the application. Service factor shall be 1.15 minimum.
- B. Motors for other than general duty application shall be furnished to suit the application and operating environment.

- C. Premium efficiency motors shall be equal to Century “E + 3”, General Electric “Energy Saver Premium Efficiency”, Baldor “Super E Premium Efficient” or Reliance “Premium Energy Efficient” series. Motor efficiencies shall be tested and conform to NEMA Standard Publication MG-1 and IEEE 112 Test Method B.
- D. Motors used with variable frequency controllers shall be rated for inverter service in accordance with NEMA Standard Publication MG-1, Part 31 and designed with Class F or H insulation, but with a Class B temperature rise.
- E. Motor sizes shown on the drawings are to be considered minimum. Motors furnished shall be sized so as to not operate in the service factor range. Motors for direct driven pumps and fans shall be selected so as to not operate in the service factor range at any point on the curve.
- F. The Plumbing Contractor and equipment suppliers shall compare the electrical power requirements of the intended equipment with power feeders to the equipment shown on the Electrical drawings. Verify adequacy and compatibility of voltage, phase, wiring, capacity, number and size of conductors (versus equipment connection points), fusing and other information on the electrical and mechanical drawings to that required for the equipment. If the selected equipment requires revision of the electrical, added cost must be borne by the Plumbing Contractor.

2.2 STARTERS

- A. Magnetic starters shall comply with provisions of Division 26 - Electrical Specifications and shall be NEMA construction (IEC rated not acceptable) with thermal overload element on each phase, 115 volt control voltage and hand-off-automatic switch, where appropriate. An integral control transformer shall be incorporated in the starter for each motor of 200 volt and greater. A single control transformer is acceptable for multiple motor packaged equipment, however, when such is the manufacturer's standard. Duplex type units (pumps, compressors, etc.) are not included in this exception. A control transformer shall be provided in each starter to insure standby operating capability.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Motor connections of factory assembled equipment shall be made with flexible conduit except for plug-in electric cord connections.
- B. All power wiring shall be run in conduit. Control wiring shall be run in conduit except where open wiring is permitted in other applicable specification sections.
- C. Fuses shall be furnished and installed in fuse clips of equipment and switches provided by the Plumbing Contractors.

END OF SECTION 22 0513

SECTION 22 0519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gauges.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 THERMOMETERS

- A. Thermometers shall be 9" blue reading organic spirit filled tube column type with cast aluminum case with epoxy finish, acrylic window, aluminum scale with white background and black markings, 1% accuracy, adjustable angle hinge assembly and 3.5" aluminum insertion stem, equal to Terrice BX91403.
- B. Thermometers shall be 5" diameter dial face bi—metallic type with adjustable angle hinge, stainless steel insertion stem and recalibration feature, equal to Terrice B85604.
- C. Provide a separable socket insertion thermowell shall be furnished with each thermometer. An extension neck, with appropriate increase in thermometer stem length, shall also be furnished where insulation thickness exceeds 2".
- D. Ranges of thermometers shall be selected from standard Fahrenheit scales to be consistent with anticipated temperatures, typically 0 deg.F.- 160 deg.F.

2.2 PRESSURE GAUGES

- A. Pressure gauges, including compound gauges and vacuum gauges, shall be Bourdon tube type with 4-1/2" dial and cast aluminum case, equal to Terrice 600C Series. Accuracy shall be 1% at mid-range.
- B. Pressure gauges for low pressure application, calibrated in inches of water gauge, ounces per sq. in. or 0-5 psi, as appropriate, shall be equal to Terrice 860.

- C. Pressure gauges at pumps shall be liquid filled Bourdon tube type with 4" dial and stainless steel case and internals, equal to Trerice 700 Series.
- D. A brass cock or bronze ball valve and a pressure snubber shall be furnished with each pressure gauge.
- E. Ranges of pressure gauges shall be selected to be consistent with anticipated pressures. Range shall be approximately twice the normal system working pressure at the gauge location.

2.3 TEST PLUGS

- A. Pressure-temperature test plugs for insertion of pressure gauge or thermometer shall be a brass fitting with neoprene or Nordel self-sealing insert and knurled brass cap with plastic capture tab. Fittings shall be equal to Peterson "PT". Furnish two thermometers and two pressure gauges with integral insertion stem appropriate for use with the test plugs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Thermometers shall be installed where shown on the drawings and also at:
- B. Pressure gauges shall be installed where shown on the drawings, where required by applicable codes and also at:
- C. Thermometers and gauges shall be positioned to be read with unobstructed view from the floor. Pressure-temperature test plugs shall be installed where shown, located in a position to be most readable.
- D. Install thermometer wells in piping tees in the vertical position. Fill the well with oil or graphite and secure the thermometer in position

END OF SECTION 22 0519

SECTION 22 0520 – COMMON PIPING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Dielectric fittings.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Piping Systems - Common Requirements.
7. Equipment installation requirements common to equipment sections.

1.2 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- B. Welders shall be qualified and fully certified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
- C. Welding procedures and testing shall comply with ANSI Standard B31.1.0 Standard Code for Pressure Piping, Power piping and The American Welding Society Welding Handbook.
- D. All pressure piping systems regulated by the Ohio Pressure Piping Systems Code, Chapter 4101:8 shall conform to applicable requirements of the Code. Welders shall carry a current State of Ohio, Pressure Piping Board Certification. Each welder shall submit a copy of their signed performance qualification record to the Engineer for approval prior to beginning work on any pressure piping system.
- E. Electrical Characteristics for Plumbing 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.

PART 2 - PRODUCTS

2.1 DIELECTRIC CONNECTORS

- A. A dielectric connector shall be incorporated at each connection between ferrous and copper piping. Connectors shall be:
 - 1. Dielectric coupling with non-conductive polymer liner, Lochinvar Corp. "V-line" Dielectric fitting on services 180 degrees and less.
 - 2. Dielectric flange with non-metallic bolt hole grommets and gasket.
 - 3. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F .

2.2 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Plastic. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 SLEEVES

- A. Schedule 40 black steel pipe or 18 gauge galvanized steel poured concrete floors, walls and roof decks.
- B. 26 gauge galvanized sheet or Schedule 40 black steel pipe in the other than poured concrete.
- C. Cast iron pipe or Schedule 40 galvanized steel pipe in exterior walls below grade, with intermediate wall stop and anchor collar set in place before concrete pouring. Sleeve shall be a part of the sealing assembly. When the wall opening is core drilled the wall sleeve may be omitted. A mechanically compressed rubber sealing assembly equal to Thunderline Corp. "Link-Seal" shall be placed in the annular space between pipe and sleeve or core drilling.
- D. Combination pre-set floor sleeve and firestopping assembly equal to Hilti CP 680.

2.4 ESCUTCHEONS

- A. Escutcheon plates shall be split-ring chromium plated pressed steel. Plates shall be sized to cover the surface penetration and sleeve. Plates shall be installed on exposed piping in finished rooms and areas where pipes penetrate walls, floors, ceilings or overhead structure.

2.5 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING 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 Coordination Drawings.
- B. Pipe and tubing shall be cut and fabricated to field measurements and run parallel to normal building lines. Pipe ends shall be cut square and ends reamed to remove burrs. The pipe interior shall be cleaned of foreign matter before erection of the pipe.
- 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. Piping shall not be run above electrical switchgear or panelboards, nor above the access space in the immediate vicinity of the equipment, in accordance with N.E.C. Article 384.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Install piping to permit valve servicing.
- H. Install piping adjacent to equipment and specialties to permit servicing and maintenance.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install piping to allow application of insulation.

- L. Select system components with pressure rating equal to or greater than system operating pressure.
- M. Install escutcheons for penetrations of walls, ceilings, and floors.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- O. Verify final equipment locations for roughing-in.

3.2 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping 2" and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping 2-1/2" and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.3 PIPE SLEEVES

- A. Pipe sleeves, floor and wall openings, water protective curbing and escutcheon plates shall be provided as described below. Pipe sleeves shall be placed in all floor slabs, poured concrete roof decks, walls and partitions, except as noted below, to allow new piping to pass thru and allow for expansion, contraction and normal movement of the pipe. Sleeves are also required for all existing piping related to the various trades in new walls, partitions, floors and roof slabs, same as for new piping.
- B. Sleeves are not required in the following:
 - 1. In floor slabs on grade.
 - 2. In stud and gypsum board or plaster walls and partitions which are not fire rated.
 - 3. For uninsulated pipe passing thru masonry walls and partitions and stud and gypsum board or plaster walls and partitions.
- C. Length of wall sleeves shall be such that the sleeve ends are substantially flush with both sides of the wall or partition. Floor sleeves shall be flush with the bottom and top of the floor slab except, in mechanical rooms and other areas which might have water on the floor, sleeves shall project a minimum of 1" above finished floor. Pipe sleeves shall be sized to allow insulation to pass thru the sleeve, for insulation requiring continuous vapor barrier (domestic cold water, chilled water refrigerant, etc.). Where vapor barrier continuity is not needed, the sleeve may be sized to pass the pipe only or the insulation as well. Refer to the following paragraph for qualification and exceptions relating to firestopping.

- D. Pipe sleeves which are part of firestopping assemblies shall conform to the requirements of the assembly with particular emphasis regarding size, annular space, length, passage or non-passage of insulation and the installation of the sleeves.
- E. Where firestopping is not required, the annular space between the sleeve, core drilling or opening and the pipe or pipe insulation shall be closed with caulking to retard the passage of smoke.
- F. Where uninsulated pipes requiring no pipe sleeves pass thru non-fire rated floor, wall or partition, the annular space shall be closed with material and methods compatible with the wall or partition material (Type M masonry grout, drywall joint compound, plaster, etc.).

3.4 Mechanical Seals

- A. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- B. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 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 SECTION 22 0520

SECTION 22 0523 – GENERAL DUTY VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Check valves.
3. Gate valves.
4. Balancing-Shutoff valves.

B. Related Sections:

1. Division 22 Plumbing piping Sections for specialty valves applicable to those Sections only. Section 22 0553 "Identification for Plumbing Systems" for valve tags and schedules.
2. Valves for natural gas, compressed air vacuum systems are specified in the system specification. See appropriate Division 22 specification.

1.2 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- C. Sweat end valves of equal construction and features are acceptable in lieu of those specified with screwed ends. Valves of equal construction and features with ends compatible with mechanical joint couplings are acceptable on such systems, and may be manufactured by the coupling system manufacturer. Grooved end valves shall conform to ANSI/AWWA Standard C-606.
- D. Ball valves in piping which is to be insulated shall have extended shaft necks to accommodate the insulation.
- E. All valve for Domestic potable water systems (cold, hot hot return, etc.) shall be “lead free” in accordance with the Federal Safe Water Act (S3874) definition and NSF/ANSI-61 approved

PART 2 - PRODUCTS

2.1 Refer to valve schedule on the Drawings for piping material and applications.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Drain valves shall be the same as for the shut-off service. Provide a ¾" hose thread adapter on the outlet of each drain valve that is not piped to a drainage point. Hose thread adapters on drain valves of potable water piping shall be fitted with a non-removable vacuum breaker.
- B. Internals shall be removed and the remaining elements of sweat end valves shall be protected against heat damage during soldering or brazing
- C. Valves shall be installed with the stem at or above the centerline of the pipe. Valves shall be located to be accessible for operation, servicing and/or removal.
- D. Packing glands shall be tightened before placing the valves in service.

END OF SECTION 22 0523

SECTION 22 0529 – PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Hanger Rods and Attachments.
 - 5. Pipe Riser Supports

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design seismic-restraint hangers and supports for piping and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS

- A. Hangers and supports for piping shall be equal to the Anvil catalog numbers as follows:
1. General service - clevis type - Fig. 260.
 2. Uninsulated copper tubing - copper plated clevis type - Fig. CT-65 (or plastic coated clevis, or fiberglass construction).
 3. Where the length of the hanger rod between the top of the hanger and the attachment is 3" or less, clevis type hangers with rollers, Fig. 181, shall be used to allow for expansion travel
- B. Hangers on insulated horizontal piping shall be oversized to surround the pipe insulation. To protect the insulation from damage or inordinate compression due to concentrated weight, the following shall be provided at each hanger:
1. Pipe 2" and smaller – Anvil Fig. 168 18 ga. sheet metal rib-lock shield with belled ends, 12" long.
 2. Pipe 2-1/2" and larger – wood blocking to prevent crushing insulation, with Anvil Fig. 168 18 ga. Sheet metal rib-lock shield with belled ends, 12" long.
- C. The first two hangers on piping connecting to motor driven equipment shall be fitted with a steel spring and neoprene vibration isolation section similar to Mason Industries, No. 30N.

2.2 TRAPEZE HANGERS

- A. Trapeze hangers for numerous pipes run in parallel may be utilized. Horizontal support members shall be unistrut type section with pipe rollers (to allow for expansion travel) and spring and nut connectors, suspended with hanger rods and attachments similar to individual pipe hanger suspension.

2.3 HANGER RODS AND ATTACHMENTS

- A. Hanger rods shall be solid steel, threaded-end or all-thread rod, of diameter listed below or matching manufacturer's provisions. A hanger attachment device (for attachment to the structure) and locking nuts at the hanger attachment shall be provided on each hanger. Locking nuts shall be provided at each clevis hanger.

<u>Pipe Size</u>	<u>Min. Rod Dia.</u>
1" and smaller	1/4"
1-1/4" to 3"	3/8"
4" to 6"	1/2"

B. Hanger rod attachment devices for attachment to the structure shall be:

1. Pre-set concrete inserts.
2. After-set steel expansion type concrete inserts.
3. Beam clamps for steel construction equal to Anvil Fig. 92, 93, or 94. Utilize swivel type in sloped steel construction to provide vertical support of pipe without bending hanger rods.
4. Side beam bracket for wood construction equal to Anvil Fig. 206.
5. Channel support system equal to Unistrut or Hilti.

2.4 PIPE RISER SUPPORTS

A. Riser clamps on cold service insulated piping shall be:

1. Insulated Pipe size 1-1/2" and smaller shall be factory (Pipe Shields E1000) or shop fabricated assembly Fig. 261 with high density calcium silicate insulation and galvanized steel jacket.
2. Insulated Pipe size 2" and greater shall be factory fabricated assembly Pipe Shields, Inc. E1000.
3. Un-insulated copper tubing – Anvil Fig CT-121 or CT-121C
4. Un-insulated steel piping – Anvil Fig. 261.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Spacing of hangers shall be as follows:

1. Steel pipe - Vertical:
 - a. At the base and 15 ft. maximum spacing unless otherwise shown.
2. Steel pipe - Horizontal:
 - a. 2" size and smaller – 8 ft. intervals
 - b. 2-1/2" thru 6" – 10 ft. intervals
 - c. 8" and larger – 12 ft.. intervals.
3. Cast iron pipe - Vertical
 - a. At the base and 15 ft. maximum spacing unless otherwise shown.
4. Cast iron pipe – Horizontal
 - a. At 10 ft. intervals.
 - b. Support each length of pipe not more than 18" from the joint.

- c. Support terminal ends of horizontal runs and branches and each change in direction.
 - d. 5" and larger provide bracing to prevent horizontal movement in accordance with CISPI "Soil Pipe and Fittings Handbook"
5. Copper Tubing - Vertical
 - a. At the base and 10 ft. maximum spacing unless otherwise shown.
6. Copper Tubing – Horizontal
 - a. 1-1/4" size and smaller – 6 ft. intervals
 - b. 1-1/2" thru 2" – 8 ft.. intervals
 - c. 2-1/2" and larger – 10 ft. intervals
7. Plastic pipe
 - a. Per manufacturer's recommendations.
- B. In piping systems with mechanical joint couplings, pipe hangers shall be provided on horizontal piping at normal specified intervals and, in addition, so that no pipe shall be left unsupported between any two couplings nor left unsupported whenever a change in direction takes place. Vertical piping shall be supported at normal specified intervals or every other pipe length, which ever is more frequent. The base of the riser or base fitting shall be supported.
- C. Attachment of pipe hangers to the structure shall be with:
 1. Provide anchoring where steel beam clamps are attached to sloping surfaces of beam flanges and where otherwise required to insure permanent attachment.
 2. Side beam bracket in wood construction, secured to the wood joist with lag screws set in drilled pilot holes.
 3. Unistrut channels with spring and nut rod connection may be utilized where a number of pipes are run parallel. Channel shall be attached to the structure with inserts or clamps.
 4. Attachment to steel deck is prohibited. Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical.
- D. Attachment to manufactured trusses and other engineered structural members and supports shall be done in strict accordance with the structural manufacturer's recommendations. Refer to the architectural and structural drawings for the type of engineered structural systems being used. Connections to these structural members shall be made with connection devices and methods approved by the structural manufacturer. Provide additional supports with supplemental steel shapes when spacing between structural members exceeds specified distances.
- E. Pipe hangers shall be adjusted to proper elevation and all hanger rods set in a vertical position before pipe insulation is installed.
- F. Extended legs of pipe riser clamps shall be shortened as needed to maintain concealment of the clamp within the pipe chase. Insure that adequate support is still maintained.

- G. Hanger assemblies which will remain exposed on completion of the project shall be painted before installation.
- H. Pipe supports manufactured by Advanced Support Products for pipe running across the roof shall be installed in accordance with the manufacturer's instructions and as detailed. Install protective slip sheets of roofing membrane under the bases to satisfy requirements of both the roofing manufacturer and the support system manufacturer.

END OF SECTION 22 0529

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SECTION 22 0530- EQUIPMENT BASES AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Equipment Supports
- B. See Division 22 Section "Vibration Control" for vibration isolation devices.
- C. See Division 22 Section "Seismic Control for Plumbing Systems".

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- B. Design seismic-restraint equipment support and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Equipment hangers and supports.
 - 2. Equipment bases.
 - 3. Support Curbs.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 CONCRETE BASES

- A. Concrete bases and pads with anchor bolts cast-in-place. Bases shall be formed on all sides and hand troweled to a smooth, dense finish with neatly chamfered corners. Large concrete pads on grade shall be constructed with reinforcing steel or reinforcing roadway mesh.
- B. Concrete inertia bases shall be as specified in Section 23 0548 "Vibration Control."

2.2 STEEL SUPPORTS

- A. Structural steel angles, beams or channels, unistrut type channels or pipe. Supports shall be fabricated into a rigid framework with welded or bolted connections and cross-bracing or sway bracing. Supports shall be set on slab with base plates, or attached to the building structure as required. Brackets for relatively lightweight equipment may be attached to the wall. Equipment shall be set on and attached to the framework.
- B. Solid steel hanger rods supported from the structure above similar to pipe hangers. Provide sway bracing for equipment supported in this manner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- B. Field Welding: Comply with AWS D1.1.
- C. Concrete bases for plumbing equipment are included in the Plumbing Contract. The Plumbing Contractor shall provide exact dimensions, locations and other details for the specific equipment provided. The Plumbing Contractor shall set anchor bolts as required for the equipment.

END OF SECTION 22 0530

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Warning markers.
4. Valve Tags

1.2 SUBMITTAL

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Labels, tags and markers shall comply with ANSI A13.1 for lettering size, colors and length of color field.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Each item or major equipment shall be labeled. This shall include water heaters, pumps, and other similar equipment.
- B. Labeling shall be:
1. Permanently attached engraved brass or plastic laminated signs with 1" high lettering. Signs on exterior equipments shall be brass.
 2. Stencil painted identification, 2" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

2.2 PIPE LABELS

- A. Pipe markings shall be applied to all piping.
- B. Labeling shall be:

1. Plastic semi-rigid snap-on type, manufacturer's standard pre-printed color coded pipe markers extending fully around the pipe and insulation or pressure-sensitive vinyl pipe markers similar to above.
2. On piping and insulation 6" and greater diameter, full band as specified above or strip-type markers fastened to the pipe or insulation with laminated or bonded application or by color-coded plastic tape not less than 1-1/2" wide, full circle at both ends of the marker.
3. Arrows for direction of flow provided integral with the pipe marker or separate at each marker.

2.3 WARNING MARKERS

- A. Underground line marker tape shall be permanent bright-colored, plastic with continuous identification lettering. Tape over service lines that cannot be detected by a metal detector shall be multi-ply with an aluminum foil core.

2.4 VALVE TAGS

- A. Each shutoff valve, other than at equipment, shall be identified with a stamped tag. Valves and tagging shall be scheduled, typewritten on 8-1/2" x 11" paper, tabulating valve number, piping system, abbreviation, location of valve (room or area) and service (e.g. – south wing reheat boxes).
- B. Valve tags shall be polished brass or plastic laminate with solid brass S hook. Tags shall be engraved with "P" for Plumbing and the designated number.

2.5 ACCEPTABLE MANUFACTURERS

- A. Labels, markings and tags shall be manufactured by W.H. Brady, Seton, Allen or Industrial Safety Supply.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification marking and tagging shall be applied after insulation and painting has been completed.
- B. Coordinate names, abbreviations and other designations used in plumbing identification work, with corresponding designations shown, specified or scheduled on drawings.
- C. The Plumbing, Fire Suppression and HVAC Contractors shall coordinate labeling, marking and tagging to attain coordinated and consistent systems of identification.
- D. Equipment labeling shall consist of unit designation as shown on the drawings.

- E. Pipe markers shall be placed at 25 ft. centers in mechanical rooms and concealed spaces and at 50 ft. centers in other exposed locations.
- F. Refer to appropriate sections of this specification for installation of underground line marker tape.
- G. Valve tags shall be placed on each valve except those intended for isolation of individual items of equipment. Valve tag schedules shall be prepared as specified above.

END OF SECTION 22 0553

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SECTION 22 0719 - PIPE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Fiberglass.
 - b. Flexible Elastomeric.
2. Protective Jacketing

1.2 SUBMITTALS

A. Product Data:

1. For each type of product indicated.
2. Thickness and covering table.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response 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.
- B. Thicknesses shall be in compliance with ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 INSULATION GENERAL

- A. Refer to insulation schedule on the Drawings for piping material and applications.
- 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. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be done by tradesmen specializing in insulation work in strict accordance with the manufacturer's recommendations.
- B. Overlap and seal all longitudinal joints. Staples and adhesive may be used as stated above. Tape and seal cross joints. Vapor barrier shall be continuous on insulation of all cold services. Vapor barrier type mastic shall be used where needed to maintain a vapor seal.
- C. Where insulation is terminated, insulation shall be beveled at 45 degrees and the beveled surface sealed with vapor barrier mastic. PVC caps over straight cut ends which have been vapor sealed may be used in lieu of beveling.
- D. Mechanical joint fittings and couplings shall be considered as a part of the pipe line and shall be insulated. Bidders on the insulation work are cautioned to verify during the bidding period the extent of this work.
- E. Insulation on cold service piping shall be run through floor and wall sleeves to maintain vapor barrier continuity. Insulation on other services may likewise be run continuous when sleeve size permits. Refer to Section 22 0529 for non-compressible insulation or blocking material and sheet metal saddles required at pipe hangers. Coordinate with the contractor on the furnishing, installation and detailed requirements of these. Provide insulation and vapor barrier on and around supports for pipe risers of services which require vapor seal so as to prevent sweating.
- F. Re-insulate piping where existing insulation has been damaged or removed in the performance of work in this project.
- G. Verify that piping has been tested before applying insulation materials and that piping surfaces are clean and dry, with foreign material removed.
- H. Fittings, valves, flanges and other devices, both exposed and concealed, requiring insulation shall be covered same thickness as pipe insulation with:
 - 1. Factory molded fitting insulation cover with PVC one-piece fitting cover.
 - 2. Miter-cut segments of pipe insulation, held in place with adhesive and/or wire, filled with insulating cement smoothed to shape and covered with PVC one-piece fitting cover.
 - 3. Oversized pipe insulation, where applicable, finished same as straight run pipe insulation.

END OF SECTION 22 071

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Unions and Flanges.
3. Dielectric Connectors.
4. Pipe Sleeves
5. Escutcheons.

1.2 SUBMITTALS

- ##### A. Product Data: For each type of product used.

1.3 QUALITY ASSURANCE

- ##### A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- ##### B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIAL

- ##### A. Refer to piping and valve schedules on the Drawings for piping materials, valves, and applications.

2.2 UNIONS AND FLANGES

- ##### A. Unions on copper tubing, all bronze construction 150 lb., solder ends.
- ##### B. Unions on steel pipe 2" and smaller, malleable iron with ground seat, bronze to steel, 300 lbs., screwed ends.
- ##### C. Flanges on steel pipe with welded or screwed joints, 2-1/2" and larger. Gaskets shall be 1/16" thickness full face compressed sheet suitable for temperature and pressure ranges of the application.
- ##### D. Mechanical joints associated with grooved end pipe are acceptable in lieu of unions and flanges.

2.3 DIELECTRIC FITTINGS

- A. Refer to Division 22 Section "Common Piping Materials and Methods" for dielectric fitting requirements.

2.4 PIPE SLEEVES

- A. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Refer to Division 22 Section "Common Piping Materials and Methods" for basic piping installation requirements.
- B. Piping shall be pitched for drainage. The low points shall be fitted with a $\frac{3}{4}$ " drain valve (with hose thread adapter if not piped to a floor drain) except that on piping 1-1/4" and smaller where a drain valve is not shown, a drain plug is acceptable. Hose thread adapters on drain valves of potable water piping shall be fitted with a non-removable vacuum breaker.
- C. Piping shall be installed consistent with good piping practice and run concealed wherever possible. Coordinate with other trades to attain a workmanlike installation.
- D. Piping shall be supported as specified in Section 22 0529 Pipe Hangers. Piping with mechanical joints for grooved end steel pipe shall be supported in accordance with the manufacturer's recommendations. Pipe alignment in both the horizontal and vertical must be tightly maintained. Misalignment must be corrected to the satisfaction of the Engineer before insulation is applied and the system accepted.
- E. Inform the Insulation sub-contractor during the bid period as to the extent of use of mechanical joints so that sub-contractor can price the work accurately.
- F. Internals of sweat end valves shall be removed when damage or warping could occur due to applied heat of soldering. Where silver brazing is specified, solder connection of valves shall be used to reduce the danger of damage. Close open ends of piping during installation to keep interior of the pipe clean.
- G. Install strainers as indicated on the drawings. Provide a nipple and ball valve in the blow down connection of each strainer 2" and larger.
- H. Unions and flanges shall be installed at pipe connections to fixtures and equipment and as required for erection purposed.
- I. Refer to Division 22 Section "Common Piping Materials and Methods" for dielectric fitting requirements.

- J. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.
- K. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements
- L. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
- M. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

3.2 FIELD QUALITY CONTROL

A. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
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. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Piping Tests:

1. Fill domestic water piping. 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. Domestic water piping – hydrostatic at 125 psig for 6 hours at the low point of the system. 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.

C. Domestic water piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 PIPE CLEANING

- A. Before placing each water piping system in operation, the piping system shall be thoroughly flushed out with clean water.

3.4 DISINFECTION OF PIPING

- A. All new and existing domestic water piping shall be disinfected by a company or personnel regularly engaged in the performance of this service.
- B. Fire suppression water piping supplied from a potable water system shall also be disinfected if the potable water systems, both public and private, is not protected by a double check valve assembly or reduced pressure backflow assembly.
- C. Disinfection shall be performed in accordance with AWWA C651- 86 Standards. Disinfection shall be by means of a chlorine solution injected into the water system near the source. Outlets throughout the system shall be tested to prove presence of minimum chlorine concentration. Flush out the system with clean water until the residual chlorine content is not greater than .2 parts per million or until approved by the Health Department.
- D. Disinfection procedures shall be witnessed by the Architect, Engineer or other qualified representative.

3.5 DOMESTIC HOT WATER RETURN SYSTEM BALANCING

- A. The domestic hot water return shall be balanced and or adjusted to provide proper operation or function in accordance with the drawings, specifications and manufacturer's recommendations.
- B. Submit balance report. Report to include:
 - 1. Project name and location.
 - 2. Architect's name and address.
 - 3. Engineer's name and address.
 - 4. Contractor's name and address.
 - 5. Report date.
 - 6. Location and information data for each recirculation pump.
 - 7. Location and information data for each balancing valve.
 - 8. Pump design and final pump performance settings.
 - 9. Balance valve design and final valve settings.
 - 10. Notes to explain why final data varies from indicated values.

END OF SECTION 22 1116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Temperature-actuated water mixing valves.
4. Strainers.
5. Hose bibbs.
6. Wall hydrants.
7. Drain valves.
8. Water hammer arresters.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1001.
3. Size: 1/4" to 3", as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1001.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: 3/4" to 3", as required to match connected piping or as noted on drawings.

6. Body: Bronze for 2" and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved/steel with interior lining complying with AWWA C550 or that is FDA approved/stainless steel for 2-1/2" and larger.
7. End Connections: Threaded for 2" and smaller; flanged for 2-1/2" and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of 2" and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of 2-1/2" and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Backflow-Preventer Test Kits

1. Manufacturers Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Point of Use Thermostatic Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradley Corporation
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a Watts Industries Co.
 - e. Symmons Industries, Inc.
2. Standard: ASSE 1070.
3. Pressure Rating: 125 psig.
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, thermometer on outlet, temperature-control handle.
8. Tempered-Water Setting: 105 deg F .
9. Tempered-Water Design Flow Rate: 0.5 gpm minimum.
10. Valve Finish: Chrome plated.

11. Piping Finish: Copper.

2.4 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves.

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: 3/4".
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.5 WATER HAMMER ARRESTERS

A. Water Hammer Arresters :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

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 backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in the same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
1. Install thermometers and water regulators if specified.
 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Install water hammer arresters on each quick closing valve in water piping according to PDI-WH 201.
- F. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- G. 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."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

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SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic hot-water recirculation:
 - 1. Close-coupled, in-line, seal less centrifugal pumps.
- B. See Division 22 Section "Domestic-Water Packaged Booster Pumps" for booster systems.

1.2 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE, SEALLESS CENTRIFUGAL PUMPS

- A. Description: Factory-assembled and -tested, single-stage, close-coupled, in-line, sealless centrifugal pumps as defined in HI 5.1-5.6.
 - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
 - 2. Casing: Bronze, with threaded companion-flange connections.
 - 3. Impeller: Corrosion-resistant material.
 - 4. Motor: Single speed, unless otherwise indicated. Comply with requirements in Division 22 Section "Electrical Requirements for Plumbing Equipment."
- B. Capacities and Characteristics:

1. Capacity: Refer to Drawings.r
2. Total Dynamic Head: Refer to Drawing for
3. Maximum Operating Pressure: 125 psig.
4. Maximum Continuous Operating Temperature: 220 deg F .
5. Inlet and Outlet Size: Refer to Drawings
6. Motor Horsepower: Refer to Drawings
7. Electrical Characteristics: Refer to Drawings

C. Acceptable Manufacturers:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Industries.
3. Grundfos Pumps Corp.
4. Taco, Inc.

2.2 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion sensor, for installation in hot-water circulation piping.
2. Range: 50 to 125 deg F.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120 V, ac.
6. Settings: Start pump at 115 deg F and stop pump at 120 deg F.
7. Acceptable Manufacturers:
 - a. Honeywell International, Inc.
 - b. Square D.
 - c. White-Rodgers Div.; Emerson Electric Co.

B. Timers: Electric time clock for control of hot-water circulation pump.

1. Type: Programmable, seven-day clock with manual override on-off switch.
2. Enclosure: Suitable for wall mounting.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120 V, ac.
6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.
7. Acceptable Manufacturers:
 - a. Honeywell International, Inc.
 - b. Intermatic, Inc.
 - c. Johnson Controls, Inc.
 - d. TORK.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install in-line, seal less centrifugal pumps with motor and pump shafts horizontally.
- E. Install continuous-thread hanger rods and spring hangers of sufficient size to support pump weight or fabricate brackets or supports as required. Hanger and support materials are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- F. Install timers on the wall in mechanical room.
- G. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- H. Install piping adjacent to pumps to allow service and maintenance.
- I. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."
 - 1. Install shutoff valve on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves for domestic water piping and Division 22 Section "Domestic Water Piping Specialties" for strainers.
 - 2. Install test plugs for pressure gage at suction and discharge of pumps. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and test plugs.
 - 3. Install thermometer at suction of pumps. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometer.
- J. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- K. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- L. Connect timers to pumps that they control.

END OF SECTION 221123

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SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.2 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.
 - 2. Pump Discharge Piping: 50 psig

1.3 SUBMITTALS

- A. Product Data: For each type of product used.
- B. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Cast iron pipe, fittings, and standard duty no-hub couplings shall be listed by NSF International and marked with "NSF" demonstrating certification.
- C. Plastic piping and components shall comply with NSF 14, "Plastics Piping Systems Components and Related Materials,". Include marking with "NSF-DWV" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.

PART 3 - EXECUTION

3.1 PIPING INSTALLATIONS

- A. Basic piping installation requirements are specified in Division 22 Section ""Common Piping Materials and Methods. "
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section " Common Piping Materials and Methods."
- D. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- E. On piping 5" and larger provide bracing at every branch opening or change in direction as required by CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. Piping suspended 18" or more shall be provided with sway bracing as required by CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- G. 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.
- H. 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.
- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow for piping smaller than 3" and; 1 percent downward in direction of flow for piping 3" and larger.
 - 2. Vent Piping: slope down toward vertical fixture vent or toward vent stack.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

- L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- N. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.
- O. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements
- P. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
- Q. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

3.2 JOINT CONSTRUCTION

- A. 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.
- B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.3 VALVE INSTALLATION

- A. Shutoff Valves: Install full-port ball valve on each sewage pump discharge.
- B. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.

3.4 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 or indicated on the drawings.
 - 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.
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections **2-1/2"** and larger.

3.5 FIELD QUALITY CONTROL

- A. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- B. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- E. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
 - 1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 2. Prepare reports for tests and required corrective action.

3.6 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. Plugs the ends of uncompleted piping at end of day and when work stops.

3.7 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 22 1316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Miscellaneous sanitary drainage piping specialties.
5. Flashing materials.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

A. Floor drains shall be as indicated on the drawings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - g. Wade Manufacturing Company Division of Tyler Pipe

2.2 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

1. The manufacturer shall be same as floor drains.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. The manufacturer shall be same as floor drains.
2. Standard: ASME A112.36.2M for adjustable housing cast-iron soil pipe with cast-iron ferrule threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Heavy-duty, threaded adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Inside caulk.
8. Closure: Plastic plug.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: [Heavy Duty.
13. Riser: ASTM A 74,Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Wall Cleanouts

1. The manufacturer shall be same as floor drains.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: as required to match connected piping.
5. Closure: Countersunk or raised-head drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round,[flat, chrome-plated brass or stainless-steel] cover plate with screw.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Description: Manufactured assembly made of 6.0-lb/sq. ft. , 0.0938-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 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. 2" : 4-inch- minimum water seal.
 - b. 2-1/2" and Larger: 5-inch- minimum water seal.

B. Floor-Drain, Trap-Seal Maintenance Device:

1. Description: Device inserted into the drain body or adjustable strainer that opens to allow water to pass thru and closes to prevent sewer gases from entering the room from the drainage system.
2. Must conform to ASSE 1072 .
3. Size: Same as floor drain outlet.

C. 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.

2.5 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 backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to 4". Use 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 for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- F. 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 1/4-inch 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.
- G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- L. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

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 Division 07 Section "Sheet Metal Flashing and Trim."
- 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 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221429 - SUMP PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes submersible sump pumps and accessories, inside the building, for building storm drainage systems.

1.2 SUBMITTALS

- A. Product Data: For each type and size of sump pump specified. Include certified performance curves with operating points plotted on curves, and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 SUBMERSIBLE SUMP PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 1. Bell & Gossett Domestic Pump; ITT Industries.
 - 2. Gorman-Rupp Company (The).
 - 3. Goulds Pumps; ITT Industries.
 - 4. Grundfos Pumps Corp.
 - 5. Liberty Pumps.
 - 6. Little Giant Pump Co.
 - 7. Weil Pump Company, Inc.
 - 8. Zoeller Company.

- B. Description: Factory-assembled and -tested, simplex, single-stage, centrifugal, end-suction, submersible, direct-connected sump pumps complying with UL 778 and HI 1.1-1.2 and HI 1.3 for submersible sump pumps.
- C. Casing and Impeller: Cast iron or plastic casing with inlet strainer and metal or plastic impeller.
- D. Pump and Motor Shaft: Steel, with factory-sealed, grease-lubricated ball bearings.
- E. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection; three-conductor waterproof power cable of length required, and with grounding plug and cable-sealing assembly for connection at pump.
- F. Controls: NEMA 250, Type 1 enclosure, pedestal-mounted float switch; with float, float rod, and rod buttons.

2.3 SUMP PUMP BASINS

- A. Description: Factory fabricated basin with sump, pipe connections, and separate cover.
- B. Sump: Fabricate watertight, with sidewall openings for pipe connections.
 - 1. Material: Fiberglass .
 - 2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
 - 3. Anchor Flange: Same material as or compatible with sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.
- C. Cover: Fabricate with openings having gaskets, seals, and bushings, for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
 - 1. Material: Steel with bituminous coating.
 - 2. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.

PART 3 - EXECUTION

3.1 SUMP PUMP INSTALLATION

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."
- B. Install sump pumps according to applicable requirements in HI 1.4.
- C. Install pumps and arrange to provide access for maintenance including removal of motors, impellers, couplings, and accessories.
- D. Set submersible sump pumps on basin floor. Make direct connections to storm drainage piping.
- E. Install sump pump basins and connect to drainage piping. Brace interior of basins according to manufacturer's written instructions to prevent distortion or collapse during concrete placement.

Set basin cover and fasten to basin top flange. Install cover so top surface is flush with finished floor.

- F. Construct sump pump pits and connect to drainage piping. Set pit curb frame recessed in and anchored to concrete. Fasten pit cover to pit curb flange. Install cover so top surface is flush with finished floor.
- G. Support piping so weight of piping is not supported by pumps.
- H. Piping installation requirements are specified in Division 22 Section "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- I. Install piping adjacent to sump pumps to allow service and maintenance.
- J. Install discharge piping equal to or greater than size of pump discharge piping.
 - 1. Install check and shutoff valves on discharge piping from each pump.
 - 2. Install unions on pumps having threaded pipe connections.
 - 3. Install valves same size as connected piping.
- K. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- L. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 221429

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SECTION 22 1613 – NATURAL GAS HOUSE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

B. All gas piping work shall be in accordance with Gas Company requirements. Verify materials selected are in conformance before installation.

C. Intermediate natural gas piping shall run between the Gas company meter setting and the building at an intermediate pressure of 2 psi.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Welding certificates.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Materials and installation shall conform to standards and requirements of the Gas Company and the Ohio Building Code including the referenced International Fuel Gas Code.

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.

2.2 Transition Service-Line Risers: Factory fabricated and leak tested.

- A. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
- B. Outlet shall be threaded or suitable for welded connection.
- C. Bridging sleeve over mechanical coupling.
- D. Tracer wire connection.
- E. Ultraviolet shield.
- F. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.3 Gas Pressure Regulators:

- A. Gas pressure regulator shall be self-operating spring loaded type. Valve body shall be cast iron, 125 psi construction with screwed or flanged connections. Spring and diaphragm casings shall be aluminum. Regulator shall have an internal relief valve assembly, tapped vent connection with removable screen on the spring casing and an external pilot operator to afford a 5% maximum droop. Over-pressure protection shall be ten times the inlet pressure (or higher as may be required by the gas company).
- B. Regulator shall be Fisher Type S102 or S202 or equal by Sprague or Equimeter. Refer to the drawings for size, capacity, inlet and outlet pressures and installation detail.

2.4 VALVES

- A. Refer to valve schedule on the Drawings for valves and applications

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Piping Materials and Methods."

B. Outdoor Piping

1. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
2. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
3. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
4. Install underground, PE, natural-gas piping according to ASTM D 2774.
5. Install fittings for changes in direction and branch connections.
6. Exterior-Wall Pipe Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
7. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
8. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 22 Section "Meters and Gages.
9. Piping installed above ground and outdoors shall be painted to protect it from corrosion.
10. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

C. Indoor Piping Installation

1. Valves, unions and threaded joints are not permitted in inaccessible locations. Valve shall not be located in ceiling air plenums and or other air plenums or ducts.
2. Comply with Gas Company for installation and purging of natural-gas piping.
3. A shutoff valve and dirt and moisture leg with screwed end cap shall be provided on the pipe drop to each item of equipment.
4. Gas pressure regulators shall be installed in accordance with the manufacturer's instructions. Provide valved gauge taps upstream and downstream of the regulator and a pressure gauge on the downstream side. Provide pilot regulator piping and miscellaneous valves, devices and piping to complete the installation.
5. Vent piping shall be extended individually from each regulator and gas venting device to outside the building in an approved location.

6. Piping installed above ground and outdoors shall be painted to protect it from corrosion.
7. Unions and flanges shall be installed at pipe connections to fixtures and equipment and as required for erection purposes.
8. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.
9. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements.
10. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
11. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

3.1 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 2. Cut threads full and clean using sharp dies.
 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 2. Bevel plain ends of steel pipe.
 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.1 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance.
- B. Install regulator with maintenance space adequate for servicing and testing.

3.2 CONNECTIONS

- A. Connect to utility's gas service according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Dirt Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.3 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction. Test pressure shall be 3 psi or 1.5 times the working pressure whichever is greater.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 22 1613

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SECTION 22 3333 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Light-commercial electric water heaters.
 - 2. Water heater accessories.

1.2 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.
- D. Warranty.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE/IESNA-90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period(s): Three years from date of Substantial Completion:

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 LIGHT-COMMERCIAL ELECTRIC WATER HEATERS

A. Description: Comply with UL 174 for household, storage electric water heaters.

1. Storage-Tank Construction: Steel, vertical arrangement.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
2. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1-2004.
 - e. Jacket: Steel with enameled finish.
 - f. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Heating Elements: Two; electric, screw-in immersion type; wired as indicated on drawings.
 - h. Temperature Control: Adjustable thermostat for each element.
 - i. Safety Control: High-temperature-limit cutoff device or system.
 - j. Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
3. Refer to the drawings for capacity and characteristics.
4. Manufacturers:
 - a. Bradford White Corporation.
 - b. Lochinvar Corporation.
 - c. Rheem Water Heater Div.; Rheem Manufacturing Company.
 - d. Ruud Water Heater Div.; Rheem Manufacturing Company.
 - e. Smith, A. O. Water Products Company.
 - f. State Industries, Inc.

2.3 WATER HEATER ACCESSORIES

- A. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches above the floor.
- B. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- C. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than 3/4".
- D. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1-2004 .

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
 - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
 - 2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial, water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- D. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.
- E. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- F. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- G. Fill water heaters with water.

3.2 CONNECTIONS

- A. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 223300

SECTION 22 4200 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Faucets for lavatories and sinks.
 2. Flushometers.
 3. Drinking Fountains
 4. Toilet seats.
 5. Protective shielding guards.
 6. Fixture supports.
 7. Dishwasher air-gap fittings.
 8. Disposers.
 9. Water closets.
 10. Urinals.
 11. Lavatories.
 12. Sinks.
 13. Service sinks.

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act" for plumbing fixtures for people with disabilities and Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- E. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Stainless-Steel Residential Sinks: ASME A112.19.3.
 - 3. Vitreous-China Fixtures: ASME A112.19.2M.
 - 4. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- F. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - 4. Faucets: ASME A112.18.1.
 - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 6. Hose-Coupling Threads: ASME B1.20.7.
 - 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 8. NSF Potable-Water Materials: NSF 61.
 - 9. Pipe Threads: ASME B1.20.1.
 - 10. Supply Fittings: ASME A112.18.1.
 - 11. Brass Waste Fittings: ASME A112.18.2.
- G. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. Brass and Copper Supplies: ASME A112.18.1.
 - 3. Dishwasher Air-Gap Fittings: ASSE 1021.
 - 4. Manual-Operation Flushometers: ASSE 1037.
 - 5. Plastic Tubular Fittings: ASTM F 409.
 - 6. Brass Waste Fittings: ASME A112.18.2.

- H. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Disposers: ASSE 1008 and UL 430.
 2. Dishwasher Air-Gap Fittings: ASSE 1021.
 3. Flexible Water Connectors: ASME A112.18.6.
 4. Hose-Coupling Threads: ASME B1.20.7.
 5. Off-Floor Fixture Supports: ASME A112.6.1M.
 6. Pipe Threads: ASME B1.20.1.
 7. Plastic Toilet Seats: ANSI Z124.5.
 8. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 Fixtures and Trim

- A. Refer to the notes/schedule on the drawings for fixture and associate trim specifications.
- B. All waste and supply trim exposed to view shall be chrome plated brass.
- C. Toilet Seats:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bemis Manufacturing Company.
 - b. Centoco Manufacturing Corp.
 - c. Church Seats.
 - d. Kohler Co.
 - e. Olsonite Corp.
 - f. Beneke Div, Sanderson Plumbing Products, Inc..
 - g. Sperzel.
 2. Description: Toilet seat for water-closet-type fixture.
 - a. Material: Molded, solid plastic with antimicrobial agent.
 - b. Configuration: Open front without cover.
 - c. Size: Elongated.
 - d. Hinge Type: self-sustaining check.
 - e. Class: Heavy-duty commercial.
 - f. Color: White.

2.2 FIXTURE CARRIERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Josam Company.
 2. MIFAB Manufacturing Inc.

3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Urinal Carriers:

1. Description: Urinal carrier with hanger and bearing plates for wall-mounting, urinal-type fixture. Include rectangular steel uprights with feet.

C. Lavatory Carriers:

1. Description: Lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include rectangular steel uprights with feet.

D. Drinking Fountain Carriers:

1. Description: Carrier with hanger and bearing plates for wall-mounted fixture. Include rectangular steel uprights with feet.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install feet and anchor lugs of carriers securely affixed to floor using all bolt holes provided.
- C. Install fixtures level and plumb according to roughing-in drawings.
- D. Attach supplies to supports or substrate within pipe spaces behind fixtures to prevent loose piping fitting piping thru walls. Install -supply stop on each water supply to each fixture connected to water distribution piping. Install stops in locations where they can be easily reached for operation.
- E. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- F. Install toilet seats on water closets.
- G. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- H. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

- I. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Adjust flow regulators for proper flow and stream height and adjust water cooler temperature settings for drinking fountains.
- F. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224200

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DIVISION 23 HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

23 0000 General Requirements for HVAC Systems

- 23 0001 Basic HVAC Requirements
- 23 0002 HVAC Work in Existing Buildings
- 23 0004 Firestopping for HVAC Systems

23 0500 Common Work Results for HVAC

- 23 0513 Electrical Requirements for HVAC Equipment
- 23 0519 Meters and Gauges
- 23 0523 General Duty Valves
- 23 0525 Flexible Pipe Connectors
- 23 0529 Pipe Hangers and Supports
- 23 0530 Equipment Bases and Supports
- 23 0548 Vibration Control
- 23 0553 Identification for HVAC Systems
- 23 0593 Testing, Adjusting and Balancing

23 0700 HVAC Insulation

- 23 0713 Duct Insulation
- 23 0716 Equipment Insulation
- 23 0719 Pipe Insulation

23 0900 Instrumentation and Control for HVAC

- 23 0913 Instruments and Control Devices
- 23 0914 Control Wiring
- 23 0923 Direct Digital Control System
- 23 0950 Variable Frequency Motor Controllers

23 2000 HVAC Piping and Pumps

- 23 2113 Hydronic Piping
- 23 2114 Hydronic Specialties
- 23 2117 Glycol Heat Transfer Fluid
- 23 2123 Hydronic Pumps
- 23 2500 HVAC Water Treatment

23 3000 HVAC Air Distribution

- 23 3113 Ductwork
- 23 3119 Plenum Casings
- 23 3300 Air Duct Accessories
- 23 3400 Fans
- 23 3600 Air Terminal Units
- 23 3713 Diffusers, Registers and Grilles
- 23 3723 Gravity Ventilators

23 5000 Central Heating Equipment

23 5100 Breechings, Chimneys and Stacks
23 5216 Condensing Boilers

23 6000 Central Cooling Equipment

23 6426 Air-Cooled Water Chillers

23 7000 Central HVAC Equipment

23 7313 Modular, Indoor Air-Handling Units

23 8000 Decentralized HVAC Equipment

23 8146 Water-Source Unitary Heat Pumps
23 8239 Unit Heaters

SECTION 23 0001 – BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the following:
1. General Requirements
 2. Definitions
 3. Scope of Work
 4. Drawings and Specifications
 5. Reference Standards
 6. Allowances, Unit Prices and Alternates
 7. Site Visit
 8. Permits, Regulations and Inspections
 9. Project Management and Coordination
 10. Temporary Utilities
 11. Workmanship
 12. Protection
 13. Painting
 14. Cleaning
 15. Miscellaneous Equipment Connections
 16. Equipment Selection
 17. Shop Drawings
 18. Final Inspection and Punch List
 19. Operation and Maintenance Manuals
 20. Record Drawings
 21. Warranties
 22. Project Closeout
 23. Operation and Adjustment of Equipment
 24. Operating Demonstration and Instruction

1.2 GENERAL REQUIREMENTS

- A. All provisions of Division 00 Front End Documents and Division 01 General Requirements apply to work specified in this Division.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this HVAC work.
- C. A complete and functional HVAC system installation shall be provided under this Division. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

- D. The Mechanical and Electrical drawings and specifications assign work (labor and/or materials to be provided by the General, Plumbing, Fire Suppression, HVAC or Electrical Contractor or their sub-contractors. Understanding that the contractors for mechanical and electrical work are sub-contractors to the (General) Contractor, such assignments are not intended to restrict the Contractor in assignment of work among the sub-contractor to accommodate trade agreements and practices or the normal conduct of the construction work.

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 SCOPE OF WORK

- A. The scope of the HVAC work includes furnishing, installing, testing and warranty of all HVAC work shown on the HVAC drawings and specified herein, including Division 00, Division 01, Division 23 and applicable provisions of other relevant Divisions.

1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word “proved,” as used, shall mean “furnish and install.” If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.
- B. Make all necessary field measurements to insure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having ductwork, pipe and fittings fabricated

and delivered in advance of making actual measurements shall be sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.

- D. The Architect/Engineer shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties.
- E. Equipment, ductwork or piping shall not be installed or run above electrical switchgear or panelboards, nor in or above the access space in the immediate vicinity of the electrical switchgear/panelboards, in accordance with NEC Article 384.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect's decision shall be final in regard to the arrangement of ductwork, piping, etc., where conflict arises.
- G. Provides offsets in system runs, additional fittings, necessary drains and minor valves, traps, dampers and devices required to complete the installation, or for the proper operation of the system. Each Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.6 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ADTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.7 ALLOWANCES, UNIT PRICES AND ALTERNATES

- A. Refer to Sections 012100 Allowances, 012200 Unit Prices and 012300 Alternates.

1.8 SITE VISIT

- A. Refer to Section 017300 Execution.
- B. Each bidder shall visit the project site to understand the existing conditions and compare the conditions with information shown on the drawings. Report immediately to the Architect any issues or discrepancies which are discovered that affect the bid. Changes to contract price will not be considered for site condition issues that are readily apparent from a thorough site review.

1.9 PERMITS, REGULATIONS AND INSPECTION

- A. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.
- B. Except where the permit application is made by the Architect or the Engineer, the HVAC contractor shall be responsible to file for and obtain all required permits from the governing inspection agencies for the HVAC work. Where the Architect or Engineer is the Architect or Engineer of record, they will furnish sealed and signed drawings and specifications required by the permit authorities.
- C. Include payment of all permit and inspection fees applicable to the work in this Division.
- D. All work shall be subject to inspection and approval of Federal, State and local agencies as may be appropriate as well as the Architect and Engineer.
- E. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.10 PROJECT MANAGEMENT AND COORDINATION

- A. Refer to Section 013100 Project Management and Coordination.
- B. The HVAC Contractor shall initially prepare and be responsible for ¼" scale coordination drawings. These drawings shall be reproduced and distributed to the Plumbing, Fire Suppression and Electrical Contractors for their input and revisions. Assure that all contractors work together to obtain finish coordinated drawings and no work being installed until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Engineer.

1.11 TEMPORARY UTILITIES

- A. Refer to Section 015000 – Temporary Facilities and Controls for division of responsibilities for temporary utilities.
- B. The use of the permanent HVAC system for temporary heating and ventilation during the latter stages of construction shall be allowed. Expedite completion of system as practicable to this end. Maintain the system during this period. Provide and maintain temporary air filters to protect coils and ducts. Replace temporary filters with the specified filters (clean) when the systems are placed on permanent duty. Air filters specified for the systems and units, including specified spare filters, are not to be used for temporary service.
- C. Cover all return duct openings with temporary filter media when recirculating air. Stop fans during heavy dust generating operations. Before turning the system over to the Owner, the Contractor shall clean duct interiors and interior surfaces and components with the air handling equipment if dirt, dust and debris have accumulated on these surfaces.

- D. Warranty periods on equipment, materials and system shall commence upon Owner acceptance of the building or system. Temporary heat use shall not jeopardize or alter the warranty requirements.

1.12 WORKMANSHIP

- A. Refer to Section 014000 Quality Requirements.
- B. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect shall have the right to stop the work if highest quality workmanship is not maintained.
- C. HVAC work shall be performed by licensed HVAC Contractors in accordance with requirements of the jurisdiction.

1.13 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide plastic sheeting, drop cloths or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.
- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of ducts, piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.14 PAINTING

- A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in Division 23:

1. Ferrous metal which is not factory or shop painted or galvanized and which remains exposed to view in the finished areas of the building / building including finished areas, mechanical rooms, storage rooms, and other unfinished areas shall be given a prime coat of paint.
 2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint.
 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.
 4. Inside of ducts, behind grilles and registers, shall be painted flat black to eliminate the viewing of shiny surfaces.
- B. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 09 Finishes. All rust must be removed before application of paint.
- C. Finish painting is included in the General Contract except where otherwise required under remodeling work. Refer to the "Cutting and Patching" paragraph in this Section for finishing requirements.

1.15 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain. The contractor shall also clean duct interiors and interior components of new or existing air handling system equipment if dirt, dust or debris have been generated in the course of work have accumulated on these surfaces.
- D. Before placing each system in operation, the equipment shall be thoroughly cleaned; cleaning shall be in accordance with equipment manufacturer's recommendations.
- E. Refer to appropriate Sections for cleaning of other equipment and systems for normal operation.

1.16 MISCELLANEOUS EQUIPMENT CONNETIONS

- A. Connections to equipment shall be in accordance with the manufacturer's installation guidelines. Any additional accessories recommended by the manufacturer such as gauges, shut-off valves, unions at connection points, etc., shall be provided by this Contractor.

1.17 EQUIPMENT SELECTION

- A. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- B. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 - 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specifications, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturer's listed.
 - 2. Where the words "or approved equal: appear after a manufacturer's name, specific approval must be obtained from the Architect during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
 - 3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.
- C. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- D. Before bidding equipment, and again in the preparation of shop drawings the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated piping and accessories. Also verify that adequate space is available for servicing of the equipment.
- E. If extensive changes in pipe, duct or equipment layout or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.18 SHOP DRAWINGS

- A. Refer to Section 016000 Product Requirements.

- B. One set of shop drawings, in electronic format (.pdf), with descriptive information shall be assembled by each Contractor of equipment and materials furnished in his contract, and submitted to the Architect and/or Engineer for review as stated in Division 01. These shall be submitted as soon as practicable and before special equipment is manufactured and before installation.
- C. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.
- D. The review of shop drawings by the Architect or Engineer shall not relieve the Contactor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- E. Shop drawings for the following HVAC equipment and materials shall be submitted:
 - 1. Pipe, fittings and joining methods for the various systems.
 - 2. Firestopping systems for pipe penetrations.
 - 3. Pipe Hangers and Supports.
 - 4. Valves.
 - 5. Flexible Connectors.
 - 6. Meters and Gauges.
 - 7. Vibration Isolators.
 - 8. Pipe Insulation.
 - 9. Equipment and Breeching Insulation.
 - 10. Ductwork Insulation.
 - 11. Ductwork and Sealing Systems.
 - 12. Air Duct Accessories.
 - 13. Tanks.
 - 14. Hydronic System Specialties.
 - 15. Pumps.
 - 16. Water Treatment Systems.
 - 17. Boilers and Burners.
 - 18. Prefabricated Stacks and Flues.
 - 19. Air-Cooled Chillers.
 - 20. Cooling Towers.
 - 21. Refrigerant piping schematic and components.
 - 22. Hydronic Heat Pump Units.
 - 23. Fan-Coil Units.
 - 24. Unit Heaters.
 - 25. Convectors.
 - 26. Central Air Handling Units.
 - 27. Fans.
 - 28. Roof Ventilators.
 - 29. Air Filters.
 - 30. Fire Dampers.
 - 31. Air Control Terminal Units.
 - 32. Diffusers, Registers and Grilles.
 - 33. Louvers.

34. Temperature Controls System.

1.19 FINAL INSPECTION AND PUNCH LIST

- A. Refer to Section 017700 Closeout Procedures.

1.20 OPERATION AND MAINTENANCE MANUALS

- A. Refer to Section 017823 Operation and Maintenance Data.
- B. All shop drawing and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams, parts list and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. Air and water balance reports shall also be included. In addition, the Contractor shall prepare a chart listing all items of equipment which are furnished under his contract and indicating the nature of maintenance required, the recommended frequency of checking these points and the type of lubricating media or replacement material required.
- C. These shall be assembled into three-ring loose lead binders or other appropriate binding. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to the Architect or Engineer for review. Upon approval, manuals shall be turned over to the Owner.

1.21 RECORD DRAWINGS

- A. Refer to Section 017839 Project Record Drawings.
- B. Each Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawing shall be turned over to the Architect.

1.22 WARRANTIES

- A. Refer to Section 017700 Closeout Procedures.
- B. This Contractor shall warrant all workmanship, equipment and material entering into this contact for a period of one year of date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect. Any materials or equipment proving to be defective during this warranty period shall be made good by this Contractor without expense to the Owner.
- C. This provision is intended specifically to cover deficiencies in contract completion or performance which are discovered after systems are placed in operation. Also included shall be supplementary assistance in balancing, adjusting or providing operating instructions as the need develops, and replacing overload heater elements in starters where necessary to keep systems in operation. Heater element sizes shall not exceed the motor manufacturer's recommendations.

- D. This provision shall not be construed to include maintenance items such as replacing filters, re-tightening or repacking glands, greasing, oiling belt tightening and cleaning strainers after these have been done for final close-out.
- E. Provisions of this warranty shall be considered supplementary to warranty provisions under General Conditions.
- F. Extended warranties shall be provided where indicated in the equipment specification sections.

1.23 PROJECT CLOSEOUT

- A. Refer to Section 017700 Closeout Procedures.

1.24 OPERATION AND ADJUSTMENT OF EQUIPMENT

- A. As each piping system and air distribution system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing air and water systems, adjusting fan speeds, belts, pulleys, tightening packing glands, and adjusting all operating equipment.
- B. Caution: Verify that all bearings are lubricated, all motors are operating in the right direction, and correct overload heater elements are provided on all motors. Do not depend wholly on the electrician's judgment in these matters. Follow specific instructions in regard to lubrication. Do not oil or grease presealed ball bearings unless upon manufacturer's specific instructions.
- C. Test relief valves, air vents and regulating valves to insure proper operation.

1.25 OPERATING DEMONSTRATION AND INSTRUCTIONS

- A. Refer to Section 017900 Demonstration and Training as well as individual Division 23 Sections for requirements.
- B. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.
- C. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- D. A minimum of 8 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:
 - 1. Show locations of items of equipment and their purpose.
 - 2. Review binder containing instructions and equipment and systems data.
 - 3. Coordinate written and verbal instructions so that personnel understand each.

4. Separate instructions shall be given by manufacturer's representatives for the temperature control systems.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION – NOT APPLICABLE

END OF SECTION 23 0001

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SECTION 23 0002 – HVAC WORK IN EXISTING BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the following:
 - 1. General Requirements for Renovation Work
 - 2. Inspection of Existing Building
 - 3. Asbestos Material
 - 4. Work Hours
 - 5. Tobacco Products
 - 6. Barriers and Signage
 - 7. Storage of Tools and Materials
 - 8. Protection of Existing Building and Equipment
 - 9. Confined Spaces
 - 10. Noise, Fumes, and Dust Control
 - 11. Soldering, Welding, and Cutting
 - 12. Removals, Disposal, and Reuse
 - 13. Draining, Flush, and Refill of Piping Systems
 - 14. Continuity of Systems

1.2 GENERAL REQUIREMENTS FOR RENOVATION WORK

- A. Refer to Article 1 Specification requirements and notes on the drawings where provided for requirements related to renovation work.
- B. Meet with the Owner, Architect and Engineer before demolition or construction begins to establish procedures for work effort in the existing building. Provide names and phone numbers and establish emergency contact information where work is performed. Provide security information requested by the Owner for all personnel who will be working on site. Educate all construction personnel in regard to the project requirements and procedures.
- C. Coordinate effort with other contractors involved in the renovation project to minimize the disruption, phasing of work, share cleaning responsibilities, etc.

1.3 INSPECTION OF EXISTING BUILDING

- A. Each bidder shall inspect the existing building in the early time frame of the bidding period. Conditions shall be compared with information shown on the drawings. Report to the Architect/Engineer any significant discrepancies which may be discovered in a timely fashion

so that direction may be provided in an addendum. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

1.4 ASBESTOS MATERIAL

- A. Abatement, removal or encapsulation of existing materials containing asbestos is not included in the Contract. Necessary work of this nature will be arranged by the Owner to be done outside of this construction and remodeling project by a company regularly engaged in asbestos abatement. Such work will be scheduled and performed in advance of work in the construction and remodeling project.
- B. If, in the performance of the mechanical work, materials are observed which are suspected to contain asbestos, the Contractor shall immediately inform the Architect / Engineer who in turn will notify the Owner. Work that would expose workers to the inhalation of asbestos particles shall be terminated. Work may be resumed only after a determination has been made and unsafe materials have been removed or encapsulated and the area declared safe.

1.5 WORK HOURS

- A. Work hours for construction shall be as defined in Section 01150 – Project Phasing or other specification sections or drawing notes.
- B. Where allowed, contractors may work normal hours except after hours is required for operations that are noisy, generate obnoxious fumes or dust, require shut down of ventilation systems, etc. The Owner reserves the right to stop normal hour work where the Owner deems the effort to be disruptive to their ongoing operations.
- C. Any work that creates hazards in or requires closure of corridors, exit pathways or stairwells work in corridors must be performed after hours when the building is not occupied.
- D. All occupied areas, corridors exit pathways and stairwells must be left clean, lighted (including emergency egress and exit signage) usable and safe at the end of each work shift.
- E. Access to the work area shall be coordinated with the Owner; follow all security protocols for parking, sign in, key control, etc. established by the Owner.

1.6 TOBACCO PRODUCTS

- A. Smoking or chewing tobacco products are expressly prohibited to be used within the building and on the premises except where specifically permitted by the Owner or in construction company trailers or vehicles where permitted by the construction company.

PART 2 - PRODUCTS- NOT APPLICABLE

PART 3 - EXECUTION

3.1 BARRIERS AND SIGNAGE

- A. Barriers and signage shall be provided as appropriate to identify work areas and to prevent unauthorized entry by non construction personnel. Refer to appropriate Division 1 specification requirements and notes on the drawings where provided.
- B. All barriers and signs should be high visibility type and be maintained at all times.

3.2 STORAGE OF TOOLS AND MATERIALS

- A. Store all site material and tools in the active job site area, specific storage areas are not provided except where otherwise noted for material and tools. The contractor is responsible for security.
- B. Storage is specifically prohibited in means of egress paths and stairwells.

3.3 PROTECTION OF EXISTING BUILDING AND EQUIPMENT

- A. The Owners' property and the property of other contractors shall be respected at all times. Provide drop clothes, visqueen or other suitable barriers where dust and debris is generated. Tape ends of barriers for sealing purposes.
- B. Provide 55 gallon drums or smaller buckets as appropriate and use funnels where draining liquid systems.
- C. Provide plywood sheets for protection of walls, floors or Owner equipment or systems that are remaining in place near demolition or new installation work where there is possible damage from heavy material or equipment.

3.4 CONFINED SPACES

- A. Notify the Owner when performing work in confined spaces. Provide a written procedure for approval and obtain approval from the Owner when so requested.
- B. All work in confined spaces shall be done in accordance with OSHA regulations.

3.5 NOISE, FUME, AND DUST CONTROL

- A. Provide barriers and ventilation as required to limit the effect from construction generated noise fume and dust control on spaces that continue to be occupied by the Owner. Refer to protection of building and equipment paragraph above. In addition to the basic protection, provide additional visqueen barriers to limit airborne migration of dust and fumes. Provide supplemental portable fans to exhaust air to the outside of the building where appropriate. Use of the Owners' ventilation systems to induce positive or negative pressure is prohibited unless authorized by the Owner. Shut off ventilation systems serving the area where use of these systems can induce fumes or dust into return or exhaust ducts. Where systems need to remain operational for occupied areas, arrange to temporarily shutoff portions of the system in the work area. Provide taped visqueen covers on HVAC air supply and exhaust devices to limit migration. Coordinate all efforts requiring modification or shutdown of ventilation systems with the Owner. Contractor shut down of these systems is prohibited without Owner permission.
- B. Arrange with the Owner when required to shutoff fire alarm or smoke detectors to perform work. With the Owners' prior approval. Cover smoke detectors where needed to prevent false alarms due to dust or fumes generated. Minimize outages and coordinate efforts to limit the effect due to false alarms.
- C. Where significant dust or fume generating work, welding or cutting operations are required for removal or new work, provide fume removal equipment with telescoping arms to locally capture the fumes. Fume exhaust shall be directed outside or adequately filtered and recirculated.
- D. Areas shall be thoroughly ventilated after completion of the work on a daily basis to remove residual odors and fumes before occupancy occurs the next day.
- E. Provide vacuum cleaners and other equipment to clean and restore conditions.

3.6 SOLDERING, WELDING, AND CUTTING

- A. For soldering, welding or cutting operations, provide insulated, fire rated barriers and blankets to isolate cover and protect remaining systems and materials, furniture, furnishings, floors, walls, ceilings, etc.
- B. Refer to noise, fume and dust control provisions in the previous paragraph.
- C. Obtain burn approval from the Owner before commencing any soldering or welding effort. Coordinate outages of fire alarm systems as noted in the previous paragraph.
- D. Provide a Fire Watch at each welding location. Fire Watch personnel shall be dedicated for the sole purpose of fire prevention during welding operations. All Fire Watch personnel shall be properly trained and equipped, including fire extinguisher, fire blanket and communication equipment for assistance request.
- E. Provide a fire extinguisher at every soldering or welding location.

3.7 REMOVALS, DISPOSAL, AND REUSE

- A. Refer to the drawings for the scope of remodeling in the existing building.
- B. Cooperate with the General Contractor regarding all removal and remodeling work. Each Contractor shall remove existing work which is associated with his trade and which will be superfluous when the new work is installed and made operational.
- C. Where piping, ductwork, equipment and other materials are noted to be removed the removal shall include all hangers and supports for these items.
- D. Extraneous ductwork and piping which is or becomes accessible shall be removed and stubs shall be capped at the first active duct or pipe encountered. Piping that is and remains inaccessible shall be abandoned. Ends of abandoned pipe shall be capped so as to be concealed by finished surfaces. Upon completion of the work, no abandoned pipe, valve, or stub shall extend thru finished floors, walls or ceilings.
- E. When it is necessary to reroute a section of active piping, the rerouted section shall be installed before removing the existing in order to minimize system down time. Rerouted sections shall be insulated as required for new work. Patch insulation on existing piping which has been damaged or removed in this work.
- F. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where directed on the premises all removed material and equipment so designated by the Owner. All material and equipment which the Owner does not wish to retain shall become the property of the Contractor responsible for removal and shall be removed from the premises and properly disposed.
- G. Disposal of materials regulated by EPA shall be done in strict accordance with latest requirements. Provide documentation to the Owner that disposal was properly executed.
- H. Remove, store and reinstall lay-in ceiling tile and grid as needed to perform work in areas where such removal and re-installation is not to be done by the General Contractor. Damaged tile and/or grid shall be replaced with new matching tile and/or grid.
- I. In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with Owner. Protect the Owner's property by providing dust covers and temporary plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.
- J. Openings left where existing equipment, ductwork, piping and supports are to be removed in existing walls and ceilings shall be patched using materials to match the existing construction, which may include fire stopping of rated walls and ceilings.

3.8 DRAINING, FLUSHING, AND REFILL OF PIPING SYSTEMS

- A. Existing liquid systems shall be drained as required before removal or connection of new piping extensions.
- B. Draining of the system shall be the responsibility of the contractor. Provide threaded connections, etc. to direct fluids to drainage points. Water systems may be drained to sanitary systems or where permitted, to storm systems. Verify any chemical treatment, inhibitors or freeze protection additives in the existing systems and obtain a permit from the local sewer authority before disposing.
- C. Provide drums or containers to accept other than water drainage and remove from the premises and properly dispose. Provide visqueen to protect Owners' property when opening pipes, even where piping has been drained to prevent damage from residual liquid that remains in the pipe.
- D. After new piping is connected and tested, flush and clean all existing piping that has been drained and new piping as specified in Section 23 0001, Basic HVAC Requirements. Provide full port, 0.75" ball valves with hose connectors as described to facilitate flushing operations.
- E. Inspect and clean any new or existing strainers at coils, heat exchangers, etc. that may become clogged due to debris that may dislodge from interior pipe surfaces due to the draining, flushing and detergent cleaning operations.
- F. During refilling and start up operations, vent all air from the system at high points. This air venting effort shall extend beyond the refill and initial start up where flow blockage due to air binding occurs.

3.9 CONTINUITY OF SYSTEMS

- A. Work shall be so planned and executed as to provide reasonably continuous services of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch-over, the Owner shall be notified in advance and outages scheduled at the Owner's reasonable convenience.
- B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline shall include tentative dates, times of day for disruption, downtime and restoration services. Submit the outline sufficiently in advance of the proposed work to allow the Architect or Engineer to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.
- C. Shutdown of systems and work undertaken during shutdown shall be bid as being done outside of normal working hours.

3.10 WALL, FLOOR, AND ROOF OPENINGS – EXISTING CONSTRUCTION

- A. Refer to Division 1 – General Requirements for information regarding cutting and patching.
- B. Plan the work well ahead of the general construction. Where pipes and ducts are to pass thru new walls, partitions, floors, roof or ceilings, place sleeves in these elements or arrange with the General Contractor to provide openings where sleeves are not practical. Where sleeves or openings have not been installed, cut holes and patch as required for the installation of this work, or pay other trades for doing this work when so directed by the Architect. Any damage caused to the building shall be repaired or rectified.
- C. Where pipes and ducts are to pass thru, above or behind existing walls, partitions, floors, roof or ceiling, cutting, patching and refinishing of same shall be included in this contract. Core drilling and saw cutting shall be utilized.
- D. All material, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Architect. Wall, floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.
- E. Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry wall where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck.
- F. The HVAC Contractor shall engage a Roofing Contractor on a subcontractor basis for roofing and roof insulation work necessitated by his work. The Roofing Contractor shall be certified for installation and repair of the roofing system so as to maintain the existing roofing warranty.

END OF SECTION 23 0002

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SECTION 23 0004 – FIRESTOPPING FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of

construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Firestopping materials shall be manufactured and/or supplied by:

1. Hilti, Inc.
2. Johns Manville.
3. Nelson Firestop Products.
4. Specified Technologies Inc.
5. 3M; Fire Protection Products Division.

2.2 FIRESTOPPING

A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. Where required, these shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every pipe or duct at penetration of all fire resistance rated walls and horizontal assemblies.
- D. Provide rigid supports for ducts or pipes on both sides of the fire resistance rated wall or assembly where required as part of the fire stop assembly.
- E. Coordinate opening size and additional framing requirement with the General Contractor for each opening to meet the firestop installation requirements.

END OF SECTION 23 0004

SECTION 23 0513 - ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for electrical work for HVAC equipment including single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation and other electrical equipment, devices, fuses, wire, conduit and installation methods.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.
- B. Refer to the Mechanical drawings and also the Electrical drawings for requirements related to each trade. Coordinate all aspects of electrical components and wiring to complete the systems.

1.3 QUALITY ASSURANCE

- A. Equipment, devices shall be designed, constructed and installed in accordance with applicable standards of NEMA and the National Electric Code. Equipment shall be tested and listed by UL or other approved agency and installed in accordance with all instructions included as part of such listing.
- B. Electrical equipment, devices, fuses, wire, conduit and methods shall comply with applicable provisions of Division 26 - Electrical.

PART 2 - PRODUCTS

2.1 MOTORS

- A. General duty motors shall be induction type 1750 rpm NEMA Design "B" with copper windings, Class B or F insulation, and motor enclosure to suit the application. Service factor shall be 1.15 minimum.
- B. Two-speed motors shall be two-winding type with six leads unless otherwise specified.

- C. Motors for other than general duty application shall be furnished to suit the application and operating environment.
- D. Premium efficiency motors shall be equal to Century “E + 3”, General Electric “Energy Saver Premium Efficiency”, Baldor “Super E Premium Efficient” or Reliance “Premium Energy Efficient” series. Motor efficiencies shall be tested and conform to NEMA Standard Publication MG-1 and IEEE 112 Test Method B.
- E. Motors used with variable frequency controllers shall be rated for inverter service in accordance with NEMA Standard Publication MG-1, Part 31, designed to handle 1600V at a 0.1 micro-second rise time and include Class F or H insulation, but with a Class B temperature rise. Motors shall be equipped with a maintenance free, conductive micro fiber, shaft grounding ring with a minimum of two rows of circumferential micro fibers to discharge electrical shaft currents within the motor and/or its bearings.
- F. Electronically Commutated Motors – Fans
 1. Motor enclosures: Totally Enclosed Fan Cooled
 2. Electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.
 3. Motors are permanently lubricated, heavy duty ball bearing type to match with the equipment load and pre-wired to the specific voltage and phase.
 4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor or integrated variable frequency drive.
 5. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
 6. Motors can achieve up to 95% efficiency, model and horsepower dependent.
- G. Motor sizes shown on the drawings are to be considered minimum. Motors furnished shall be sized so as to not operate in the service factor range. Motors for direct driven pumps and fans shall be selected so as to not operate in the service factor range at any point on the curve.
- H. The HVAC Contractor and equipment suppliers shall compare the electrical power requirements of the intended equipment with power feeders to the equipment shown on the Electrical drawings. Verify adequacy and compatibility of voltage, phase, wiring, capacity, number and size of conductors (versus equipment connection points), fusing and other information on the electrical and mechanical drawings to that required for the equipment. If the selected equipment requires revision of the electrical, added cost must be borne by the HVAC Contractor.

2.2 STARTERS

- A. Magnetic starters shall comply with provisions of Division 26 - Electrical Specifications and shall be NEMA construction (IEC rated not acceptable) with thermal overload element on each phase, 115 volt control voltage and hand-off-automatic switch, where appropriate. An integral control transformer shall be incorporated in the starter for each motor of 200 volt and greater. A single control transformer is acceptable for multiple motor packaged equipment, however, when such is the manufacturer's standard. Duplex type units (pumps, compressors, etc.) are

not included in this exception. A control transformer shall be provided in each starter to insure standby operating capability.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Motor connections of factory assembled equipment shall be made with flexible conduit except for plug-in electric cord connections.
- B. All power wiring shall be run in conduit. Control wiring shall be run in conduit except where open wiring is permitted in other applicable specification sections.
- C. Fuses shall be furnished and installed in fuse clips of equipment and switches provided by the Mechanical Contractors.

END OF SECTION 23 0513

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SECTION 23 0519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Thermometers.
 2. Pressure Gauges.
 3. Pressure-Temperature (PT) Test Plugs.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 THERMOMETERS

- A. Thermometers shall be 9" blue reading organic spirit filled tube column type with cast aluminum case with epoxy finish, acrylic window, aluminum scale with white background and black markings, 1% accuracy, adjustable angle hinge assembly and 3.5" aluminum insertion stem, equal to Terice BX91403.
- B. Provide a separable socket insertion thermowell shall be furnished with each thermometer. A lagging extension neck, with appropriate increase in thermometer stem length, shall also be furnished where piping is insulated.
- C. Ranges of thermometers shall be selected from standard Fahrenheit scales to be consistent with anticipated temperatures, typically, 0°F – 160°F for chilled systems and 30°F – 240°F for heating systems, and 0°F – 100°F for condenser water systems.

2.2 PRESSURE GAUGES

- A. Pressure gauges, including compound gauges and vacuum gauges, shall be Bourdon tube type with 4-1/2" dial and cast aluminum case, measuring in psi, equal to Terice 600CB Series. Accuracy shall be 1% at full scale.
- B. Pressure gauges for low pressure application, calibrated in inches of water gauge, ounces per sq. in., or 0-5 psi, as appropriate, shall be equal to Terice 860.

- C. Pressure gauges at pumps shall be glycerine liquid filled Bourdon tube type with 4" dial and stainless steel case and internals, measuring in psi, equal to Trerice 700 Series. Accuracy to be 1% at full scale.
- D. A brass cock or bronze ball valve and a pressure snubber shall be furnished with each pressure gauge.
- E. Ranges of pressure gauges shall be selected to be consistent with anticipated pressures. Range shall be approximately twice the normal system working pressure at the gauge location.

2.3 PRESSURE-TEMPERATURE (PT) TEST PLUGS

- A. Pressure-temperature test plugs for insertion of a pressure gauge or thermometer shall be a brass fitting with neoprene or Nordel self-sealing insert and knurled brass cap with plastic capture tab. Fittings shall be equal to Peterson "PT". Furnish two thermometers and two pressure gauges with integral insertion stem appropriate for use with the test plugs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Thermometers shall be installed where shown on the drawings and also at: inlet and outlet of boilers, chillers, air handling units.
- B. Pressure gauges shall be installed where shown on the drawings, where required by applicable codes and also at: inlet and outlet piping of pumps, boilers, chillers, hydronic filters, upstream and downstream of pressure regulators.
- C. Thermometers and gauges shall be positioned to be read with unobstructed view from the floor. Pressure-temperature test plugs shall be installed where shown, located in a position to be most readable.
- D. Install thermometer wells in piping tees in the vertical position. Fill the well with oil or graphite and secure the thermometer in position.

END OF SECTION 23 0519

SECTION 23 0523 – GENERAL DUTY VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Butterfly valves.
2. Ball valves.
3. Check valves.
4. Balancing-Shutoff valves.

B. Related Sections:

1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.2 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- C. Sweat end valves of equal construction and features are acceptable in lieu of those specified with screwed ends. Valves of equal construction and features with ends compatible with grooved end pipe mechanical joint couplings are acceptable on such systems, and may be manufactured by the coupling system manufacturer. Grooved end valves shall conform to ANSI/AWWA Standard C-606.
- D. Butterfly valves and ball valves in piping which is to be insulated shall have extended shaft necks to accommodate the insulation.

PART 2 - PRODUCTS

2.1 SHUT OFF AND BALANCING VALVES

- A. See Drawing schedule for valve types.

2.2 MANUFACTURERS

- A. Valves shall be as specified above, or of equal construction manufactured by:
 - 1. Anvil
 - 2. Apollo
 - 3. Nibco
 - 4. Bell & Gossett
 - 5. Crane/Stockham
 - 6. Flow Design
 - 7. Watts

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Drain Valves – Drain valves shall be the same as for the shut-off service. Provide a 3/4" hose thread adapter on the outlet of each drain valve that is not piped to a drainage point. Hose thread adapters on drain valves of potable water piping shall be fitted with a non-removable vacuum breaker.
- B. Protection – Internals shall be removed, and the remaining elements of sweat end valves shall be protected against heat damage during soldering or brazing.
- C. Valve Installation – Valves shall be installed with the stem at or above the centerline of the pipe. Valves shall be located to be accessible for operation, servicing and/or removal.
- D. Adjustments – Packing glands shall be tightened before placing the valves in service.

END OF SECTION 23 0523

SECTION 23 0525 – FLEXIBLE PIPE CONNECTORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Corrugated Metal Pipe Connectors

1.2 SUBMITTALS

- A. Product Data:
- B. Shop Drawings:

PART 2 - PRODUCTS

2.1 CORRUGATED METAL

- A. Corrugated metal pipe connectors shall be constructed of seamless corrugated inner tubing of Type 300 series stainless steel, woven wire braid outer jacket of the same alloy and flanged or grooved ends. Rated working pressure shall be safely in excess of the duty imposed. Pipe connectors shall be equal to Metraflex “MMC Metra-Mini”.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Flexible pipe connectors and piping shall be installed in accordance with manufacturer’s recommendations. Piping shall be aligned (both axially and radially), movement of piping shall be confined and flange spacing set so as to not stress the connector or piping.

END OF SECTION 23 0525

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SECTION 23 0529 – PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Hanger Rods and Attachments.
- B. See Division 23 Section “Metal Ducts” for duct hangers and supports.

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design seismic-restraint hangers and supports for piping and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS

A. Hangers and supports for piping shall be equal to the Anvil catalog numbers as follows:

1. General Service – clevis type – Anvil Fig. 260.
2. Uninsulated Copper Tubing - copper plated clevis type – Anvil Fig. CT-65 (or plastic coated clevis).
3. Where the length of the hanger rod between the top of the hanger and the attachment is 3" or less, clevis type hangers with rollers, Anvil Fig. 181, shall be used to allow for expansion travel

B. Hangers on insulated horizontal piping shall be oversized to surround the pipe insulation. To protect the insulation from damage or inordinate compression due to concentrated weight, the following shall be provided at each hanger:

1. Pipe 2" and smaller – Anvil Fig. 168 18 ga. sheet metal rib-lock shield with belled ends, 12" long.
2. Pipe 2-1/2" and larger – Factory fabricated assembly equal to Pipe Shields, Inc. A1000.

2.2 TRAPEZE HANGERS

A. Trapeze hangers for numerous pipes run in parallel may be utilized. Horizontal support members shall be unistrut type section with pipe rollers (to allow for expansion travel) and spring and nut connectors, suspended with hanger rods and attachments similar to individual pipe hanger suspension.

2.3 HANGER RODS AND ATTACHMENTS

A. Hanger rods shall be solid steel, threaded-end or all-thread rod, of diameter listed below. A hanger attachment device (for attachment to the structure) and locking nuts at the hanger attachment shall be provided on each hanger. Locking nuts shall be provided at each clevis hanger.

B. Pipe Hanger Rod Size Schedule

<u>Pipe Size</u>	<u>Min. Rod Dia.</u>
1" and smaller	1/4"
1-1/4" to 3"	3/8"
4" to 6"	1/2"
8"	5/8"

C. Hanger rod attachment devices for attachment to the structure shall be:

1. After-set steel expansion type concrete inserts.
2. Beam clamps for steel construction equal to Anvil Fig. 92, 93, or 94. Utilize swivel type in sloped steel construction to provide vertical support of pipe without bending hanger rods.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Spacing of hangers shall be as follows (or as otherwise indicated on the drawings for chilled water located in the attic space).
 1. Steel pipe - Horizontal:
 - a. 2" and smaller – 8 ft. intervals
 - b. 2-1/2" thru 6" – 10 ft. intervals
 2. Copper Tubing – Horizontal
 - a. 1-1/4" and smaller – 6 ft. intervals
 - b. 1-1/2" – 2" – 8 ft. intervals
 - c. 2-1/2" and larger – 10 ft. intervals
- B. Pipe hangers shall be attached to structure. Attachment directly to gypsum board ceilings is not acceptable.
- C. Pipe hangers shall be adjusted to proper elevation and all hanger rods set in a vertical position before pipe insulation is installed.
- D. Hanger assemblies which will remain exposed on completion of the project shall be painted before installation.

END OF SECTION 23 0529

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SECTION 23 0530- EQUIPMENT BASES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Equipment Bases

PART 2 - PRODUCTS

2.1 CONCRETE BASES

A. Concrete base pad with steel reinforcement as detailed on the drawings. Bases shall be formed on all sides and hand troweled to a smooth, dense finish with neatly chamfered corners. Large concrete pads on grade shall be constructed with reinforcing steel or reinforcing roadway mesh.

END OF SECTION 23 0530

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SECTION 23 0548 - VIBRATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Vibration Isolators

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Indicate inertia bases and locate vibration isolators.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Neoprene Mounts

1. Mount: Double deflection neoprene with a minimum static deflection of 0.35". All metal surfaces shall be neoprene covered to prevent corrosion and have friction pads both top and bottom.
2. Mason Industries Series "ND"

B. Neoprene Pad Isolators

1. Pad shall be 1" thick sandwich type consisting of a 0.5" cork center with 0.25" neoprene waffle pad top and bottom.
2. Mason Industries Series "NK".

C. Spring Hanger

1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
2. Housings: Neoprene in shear or double deflection LDS rubber upper and lower elements.
3. Mason Industries Series "30N"

D. Neoprene in Shear Hanger

1. Element: Double deflection LDS rubber isolator color coded for load carrying capacity.
2. Mason Industries Series "HD".

2.2 MANUFACTURERS

- A. Mason Industries.
- B. Kinetics Noise Control
- C. Amber Booth

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Isolators installed outside shall be furnished weather protected with springs PVC coated and other ferrous parts hot dip galvanized or cadmium plated.

3.2 INSTALLATION

- A. Follow manufacturer's instructions in setting and adjusting isolators. Insure that no direct hard surface to surface contact occurs. Fasten device to floor as recommended by the isolation supplier.
- B. Where electrical connections are to be made to equipment mounted on isolators, inform the Electrical Contractor to connect to the equipment with flexible conduits.
- C. See Specification Section 23 0529 Pipe Hangers and Supports for spring hanger locations and hanger installation requirements.
- D. Adjust isolators after piping system is at operating weight.
- E. 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.
- F. Adjust active height of spring isolators.
- G. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 23 0548

SECTION 23 0553 - IDENTIFICATION FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment Labels.
 2. Pipe Labels.
 3. Valve Tags.
 4. Duct Labels.
 5. Controls Equipment Labels.

1.2 SUBMITTAL

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Labels, tags and markers shall comply with ANSI A13.1 for lettering size, colors and length of color field.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Each item or major equipment shall be labeled. This shall include boilers, chillers, pumps, air handling units, fans, condensers, and other similar equipment.
- B. Labeling shall be:
1. Permanently attached engraved brass or plastic laminated signs with 1" high lettering. Signs on exterior equipment shall be brass.
 2. Stencil painted identification, 2" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

2.2 PIPE LABELS

- A. Pipe markings shall be applied to all piping.
- B. Labeling shall be:

1. Plastic semi-rigid snap-on type, manufacturer's standard pre-printed color coded pipe markers extending fully around the pipe and insulation or pressure-sensitive vinyl pipe markers similar to above.
 2. On piping and insulation 6" and greater diameter, full band as specified above or strip-type markers fastened to the pipe or insulation with laminated or bonded application or by color-coded plastic tape not less than 1-1/2" wide, full circle at both ends of the marker.
- C. Identification markings shall include service (e.g. hot, chilled, steam) and arrows indicating direction of fluid flow provided integral with the pipe marker or separate at each marker.

2.3 VALVE TAGS

- A. Each shutoff valve, other than at equipment, shall be identified with a stamped tag. Valves and tagging shall be scheduled, typewritten on 8-1/2" x 11" paper, tabulating valve number, piping system, abbreviation, location of valve (room or area) and service (e.g. – south wing reheat boxes).
- B. Valve tags shall be polished brass or plastic laminate with solid brass S hook. Tags shall be engraved with "H" for HVAC and the designated number.

2.4 DUCT LABELS

- A. Duct markings shall be applied to all ductwork.
- B. Identification markings shall include service (e.g. supply, return, exhaust, outside air) and direction of air flow provided integral with duct marker or separate at each marker.
- C. Duct markings shall be laminated plastic color-coded pressure sensitive vinyl tape, 2-1/2" width, 3 mil minimum thickness.

2.5 CONTROLS EQUIPMENT LABELS

- A. Each controls device or major controls equipment shall be labeled to match controls drawings. This shall include thermostats, switches, sensors, controllers, panels and other similar equipment.
1. Equipment labels - Self-Adhesive, Engraved, Laminated Phenolic Label: Adhesive backed, with black letters on a white background. The minimum letter height shall be 3/8 inch.
 2. Device labels - Marker Tape: Self-laminating, clear polyester, 3/8" high tape with black lettering.

2.6 ACCEPTABLE MANUFACTURERS

- A. Labels, markings and tags shall be manufactured by:
 - 1. W.H. Brady
 - 2. Seton
 - 3. Allen
 - 4. Industrial Safety Supply

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification marking and tagging shall be applied after insulation and painting has been completed.
- B. Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled on drawings.
- C. The Plumbing, Fire Suppression and HVAC Contractors shall coordinate labeling, marking and tagging to attain coordinated and consistent systems of identification.
- D. Equipment labeling shall consist of unit designation as shown on the drawings. Exhaust labeling shall also indicate service of room or area of service.
- E. Pipe and duct markers shall be placed at 25 ft. centers in mechanical rooms and concealed spaces and at 50 ft. centers in other exposed locations.
- F. Valve tags shall be placed on each valve except those intended for isolation of individual items of equipment. Valve tag schedules shall be prepared as specified above.

END OF SECTION 23 0553

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SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
 - 2. Hydronic Piping Systems:
 - a. Variable-flow systems.
 - 3. Verifying that automatic control devices are functioning properly.
 - 4. Reporting results of activities and procedures specified in this Section.

1.2 SUBMITTALS

- A. Strategies and Procedures Plan: Within 60 days from Contractor's Notice to Proceed, submit 6 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- B. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

1.3 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by AABC or NEBB.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems." SMACNA's TABB "HVAC Systems - Testing, Adjusting, and Balancing."

- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1,

1.4 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- 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.

1.5 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - 1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- D. Examine system and equipment test reports.

- E. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- F. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- G. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- H. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- I. Examine strainers for clean screens and proper perforations.
- J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine system pumps to ensure absence of entrained air in the suction piping.
- M. Examine equipment for installation and for properly operating safety interlocks and controls.
- N. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
 - 5. Sequence of operation for control modes is according to the Contract Documents.
 - 6. Controller set points are set at indicated values.
 - 7. Interlocked systems are operating.
 - 8. Changeover from heating to cooling mode occurs according to indicated values.
- O. 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 system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's TABB "HVAC Systems - Testing, Adjusting, and Balancing" and this Section.
 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

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 outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.

- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling unit components.
- L. Check for proper sealing of air duct system.

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 fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
 - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 - 5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 - 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. 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 terminal outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 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 maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 3. Measure total system airflow. Adjust to within indicated airflow.
 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 8. Record the final fan performance data.
- C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Balance systems similar to constant-volume air systems.
 2. Set terminal units and supply fan at full-airflow condition.
 3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 4. Readjust fan airflow for final maximum readings.
 5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
 6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
 7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
 8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
- D. 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 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 outside airflow. Adjust the fan and balance the return-air ducts and inlets 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 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 expansion tank liquid level.
 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.
 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.
 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:
 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within plus or minus 5 percent of design.

- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 - 1. Determine the balancing station with the highest percentage over indicated flow.
 - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 - 3. Record settings and mark balancing devices.
- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

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 for hydronic systems.

3.10 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer, model, and serial numbers.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.11 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. If 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 kilowatt.
 - 5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatt.
 - 6. Capacity: Calculate in tons of cooling.
 - 7. If air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.12 PROCEDURES FOR BOILERS

- A. If hydronic, measure entering- and leaving-water temperatures and water flow.

3.13 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Water Coils: Measure the following data for each coil:
 - 1. Entering- and leaving-water temperature.
 - 2. Water flow rate.
 - 3. Water pressure drop.

3.14 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.15 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. 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, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB firm.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB firm 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, type size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports varies from indicated values.
 - 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.

END OF SECTION 23 0593

SECTION 23 0713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Fiberglass.

1.2 SUBMITTALS

A. Product Data:

1. For each type of product indicated.
2. Thickness and covering table.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response 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.

PART 2 - PRODUCTS

2.1 GENERAL

- A. See schedule on drawings for duct system insulation type and thickness
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Manufacturers
 1. Johns Manville Corporation

2. Owens Corning Corp.
3. Knauf Fiber Glass
4. Manson
5. CertainTeed

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be done by tradesmen specializing in insulation work in strict accordance with manufacturer's recommendations.
- B. Blanket insulation shall be wrapped tight to the duct. Insulation shall be secured to ducts 20" wide and greater with weld pins and fasteners, 18" on center maximum. Adhesive shall be applied to the duct as an aid to installation and adhesion. Vapor barrier jacket shall be lapped, stapled and sealed with adhesive and 3" wide FSK pressure sensitive tape.
- C. Board insulation with factory applied jacket shall be secured to the duct with weld pins and fasteners, 12" on center maximum. Vapor barrier jacket shall be lapped, stapled and sealed with adhesive and 3" wide ASJ pressure sensitive tape.
- D. Ductwork which is internally lined with acoustical insulation, flexible ductwork with factory applied insulation and fiberglass ductwork need not be further insulated. Required internal lining is shown on the drawings. Refer to Section 23 3113 Ductwork and coordinate with the various trades.
- E. Reinsulate existing ductwork where existing insulation has been damaged or removed in the performance of work in this project.

END OF SECTION 23 0719

SECTION 23 0716 – EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Insulation Materials:
 - a. Fiberglass.
 - b. Foam Plastic.
 - 2. Protective Jacketing

1.2 SUBMITTALS

- A. Product Data:
 - 1. For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response 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. Thicknesses shall be in compliance with ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 INSULATION GENERAL

- 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.

2.2 FIBERGLASS INSULATION

- A. Fiberglass board – 3 p.s.f. semi-rigid board with factory applied “all service” jacket.
- B. Fiberglass pipe insulation – tubular with factory applied “all service” jacket with overlapping longitudinal joints with integral seal.
- C. Vapor barrier jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.
- D. Manufactures:
 - 1. Johns Manville Corporation
 - 2. Owens Corning Corp.
 - 3. Knauf Fiber Glass
 - 4. Manson

2.3 FOAM PLASTIC

- A. Flexible closed cell foamed elastomeric insulation applied with an air dried, contact adhesive compatible with insulation.
- B. Manufacturers:
 - 1. Armstrong
 - 2. Rubatex
 - 3. Armacell International

2.4 PROTECTIVE JACKETING

- A. PVC Plastic
 - 1. One piece molded type fitting covers and sheet material, 10 mill thickness, off white color. Connection with special Z-joint closure and factory supplied snap-straps.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fiberglass board insulation shall be secured with weld pins and fasteners, 12" on center maximum, and joints sealed with 3" wide ASJ pressure sensitive tape. Tank ends shall be blocked in with insulation, pinned, and finished with glass lagging cloth and mastic.
- B. Fiberglass pipe insulation shall be applied with sealed overlapping longitudinal joints and, if necessary, secured with staples and mastic. Butt joints shall be sealed with 3" wide ASJ pressure sensitive tape.
- C. Calcium silicate blocks shall be applied, wired or banded in place and joints and cracks filled with insulating cement. 1/2" thickness insulating cement shall be applied, shaped and smoothed and finished with glass lagging cloth.
- D. Foam plastic insulation shall be held in place with adhesive. All joints shall be sealed with a vapor tight mastic. Insulation on removable chiller water boxes and heads shall be contained in a galvanized steel metal protective housing designed for easy removal.

3.2 SCHEDULE

- A. Water chiller surfaces not factory insulated which, in operation, will be cold (evaporator tank heads, piping, etc.).
 - 1. 1" thickness foam plastic insulation.
- B. Chilled water pump casings.
 - 1. 1" thickness foam plastic or fiberglass.
- C. Large chilled water air/dirt eliminator fittings
 - 1. 1" thickness foam plastic or fiberglass.

END OF SECTION 23 0716

SECTION 23 0719 - PIPE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Fiberglass.
 - b. Calcium Silicate
 - c. Flexible Elastomeric.
2. Protective Jacketing

1.2 SUBMITTALS

A. Product Data:

1. For each type of product indicated.
2. Thickness and covering table.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E84, 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. Thicknesses shall be in compliance with most current version of ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 INSULATION GENERAL

- 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. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- D. Stainless Steel Pipe Insulation Products
 - 1. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

2.2 FIBERGLASS INSULATION

- A. Factory molded tubular fiberglass with “all service” jacket having an integral vapor barrier. Longitudinal joints of the jacket shall be overlapping with factory applied adhesive. In lieu of the factory adhesive, staples on 6” centers may be used with vapor barrier mastic applied to seal both the joint and staple holes. Butt joints shall be sealed with 3” wide ASJ pressure sensitive tape.
- B. Vapor barrier jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- C. Manufacturers:
 - 1. Johns Manville Corp.
 - 2. Owens Corning Corp.
 - 3. Knauf Fiber Glass
 - 4. Manson Insulation Inc.

2.3 CALCIUM SILICATE INSULATION

- A. Molded pipe or block form insulation, 1200°F rated service, thermal conductivity, $k = 0.54$ at 500°F mean temperature. Fittings and joints shall be insulated with molded insulation fittings, or machined segmented section of calcium silicate. Insulation and fittings shall be field covered with glass lagging cloth except where metal jacket is specified.
- B. Manufacturers:
 - 1. ITW (Pabco-Childers)
 - 2. Calsilite
 - 3. Johns Manville Corp. (I.I.G.) #Thermo-12 Gold

2.4 FLEXIBLE ELASTOMERIC INSULATION

- A. Factory molded tubular preformed flexible elastomeric cellular rubber insulation applied with an air dried, contact adhesive compatible with insulation.
 - 1. Minimum Service Temperature: -40°F.
 - 2. Maximum Service Temperature: 220°F.
 - 3. Connection: Waterproof vapor barrier adhesive.

- B. Manufacturers:
 - 1. Aeroflex
 - 2. Armacell International
 - 3. Rubatex

2.5 PROTECTIVE JACKETING

- A. PVC Plastic
 - 1. One piece molded type fitting covers and sheet material, 10 mill thickness, off white color. Connection with special Z-joint closure and factory supplied snap-straps.
- B. Aluminum Jacket
 - 1. Formed aluminum sheet, 0.016" thickness, smooth finish with longitudinal slip joints and 2" laps. Fitting covers shall be same thickness die shaped fitting covers with factory attached protective liner.
 - 2. Metal jacket bands shall be 3/8" wide, 0.015" thick aluminum.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be done by tradesmen specializing in insulation work in strict accordance with manufacturer's recommendations.
- B. Overlap and seal all longitudinal joints. Staples and adhesive may be used as stated above. Tape and seal cross joints. Vapor barrier shall be continuous on insulation of all cold services. Vapor barrier type mastic shall be used where needed to maintain a vapor seal.
- C. Where insulation is terminated, insulation shall be beveled at 45° and the beveled surface sealed with vapor barrier mastic. PVC caps over straight cut ends which have been vapor sealed may be used in lieu of beveling.
- D. Mechanical joint fittings and couplings shall be considered as a part of the pipe line and shall be insulated. Bidders on the insulation work are cautioned to verify during the bidding period the extent of this work.
- E. Insulation on cold service piping shall be run through floor and wall sleeves to maintain vapor barrier continuity. Insulation on other services may likewise be run continuous when sleeve size permits. Refer to the Piping Material and Methods Section for special considerations which must be given at fire-rated wall and floor penetrations. Refer to Section 230529 - Pipe Hangers and Supports for non-compressible insulation or blocking material and sheet metal saddles required at pipe hangers. Coordinate with the piping contractor on the furnishing, installation and detailed requirements of these. Provide insulation and vapor barrier on and around supports for pipe risers of services which require vapor seal so as to prevent sweating.

- F. Re-insulate piping where existing insulation has been damaged or removed in the performance of work in this project. Document any existing damaged insulation not covered in and provide time and materials price for replacement.
- G. Verify that piping has been tested before applying insulation materials and that piping surfaces are clean and dry, with foreign material removed.
- H. Fittings, valves, flanges, and other devices, both exposed and concealed, requiring insulation shall be covered same thickness as pipe insulation with:
 - 1. Factory molded fitting insulation cover with PVC one-piece fitting cover.
 - 2. Miter-cut segments of pipe insulation, held in place with adhesive and/or wire, filled with insulating cement smoothed to shape and covered with PVC one-piece fitting cover.
 - 3. Fiberglass blanket insulation, held in place and covered with PVC one-piece fitting cover.
 - 4. Oversized pipe insulation, where applicable, finished same as straight run pipe insulation.
- I. Protective aluminum/PVC jacketing shall be provided on insulation chilled water piping.

3.2 SCHEDULE

- A. Refer to Schedule on Drawings for respective systems, types and thicknesses.
 - 1. Insulation is to be omitted on:
 - a. Hot water valves, devices, specialties and related items, 2" size and smaller, except as stated below.
 - b. Hot water piping inside cabinetry of cabinet unit heaters,
 - c. Hot water control valve piping assembly. Insulate piping between the coil and assembly.
 - d. Condensate drainage piping
 - e. Condenser water piping
 - f. Heat pump circulating water system, except as otherwise specified.
 - g. Blow-down piping and safety relief valve discharge piping.
- B. Refrigerant piping shall be insulated with 1" insulation. Inside the building insulation shall be fiberglass with all service jackets. Outside the building insulation shall be flexible elastomeric insulation with aluminum protective jacketing.

END OF SECTION 23 0719

SECTION 23 0913 - INSTRUMENTS AND CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes instruments and control devices for HVAC Direct Digital Control (DDC) systems and components.
 - 1. Electronic Sensors
 - a. Thermistor Temperature Sensors & Transmitters
 - b. Humidity Sensors
 - c. Pressure Transmitters & Transducers
 - 2. Status Sensors
 - 3. Thermostats
 - 4. Actuators
 - 5. Control Valves
 - 6. Dampers

- B. Related Sections:
 - 1. Section 23 0914 – Control Wiring and Cabling
 - 2. Section 23 0923 – Direct Digital Control System
 - 3. Section 23 0950 – Variable Frequency Motor Controllers

1.2 SUBMITTALS

- A. Product Data: For each control component indicated.

- B. Shop Drawings:
 - 1. Each control component; shall be labeled for proposed usage and its corresponding item tag per the control drawing, diagram and sequence of operation submittal.
 - 2. Damper schedule.
 - 3. Valve schedule.
 - 4. Floor plans.

- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Where a list of manufacturers is not provided, products offered by the controls system contractor or their preferred vendor may be incorporated, subject to compliance with the specification.
- B. Where a list of manufacturers is provided under components below, the product shall be selected only from the list of manufacturers provided.

2.2 CONTROL SYSTEM COMPONENTS

- A. Refer to Section 23 0923 “Direct Digital Control System” for manufacturers and specifications for the DDC system, including operator workstation, distributed controllers, network requirements, accessories, control software and graphic requirements.
- B. Refer to Section 23 0914 “Control Wiring and Cabling” for power wiring, control cabling, transformers, fusing power distribution cabinets and power line filtering for the DDC system.
- C. Control system components specified in this Section include sensors, detection equipment, indicators, thermostats, humidistats, air flow measuring stations, meters, actuators, control valves and dampers.

2.3 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, pipe immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors & Transmitters:
 - 1. Accuracy: $\pm 0.36^{\circ}\text{F}$ at calibration point.
 - 2. Wire: Twisted, shielded-pair cable.
 - 3. Single Point Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 10 sq. ft.
 - 4. Averaging Elements in Ducts: 36 inches long, flexible for ducts 10-20 sq. ft. and 72 inches long, flexible for ducts over 20 sq. ft.
 - 5. Insertion Elements for Liquids: Brass or stainless-steel socket with insertion length of:
 - a. 2-1/2” for pipes 8” and smaller
 - 6. Wall Mounted Temperature Sensor:
 - a. Manufacturer's standard cover, approximately 3”W.x 5”H.x 1”D., white color, conforming to NEMA-1 requirements. UL listed. Surge immunity compliance with IEEE C62.41.
 - b. Digital LCD display for system values such as setpoints, operating mode (occupied/unoccupied/override), VAV discharge air temperature, etc.
 - c. LED override status light.
 - d. Three button keypad for temperature setpoint adjustment up/down and timed override (typical for VAV box application).

- e. Four button keypad for temperature setpoint adjustment up and down, timed override, heat/cool/off/auto selection and fan on/off/speed/auto selection (heat pump). Provided by heat pump unit manufacturer.
 - f. Separate wiring subbase and electronics.
 - g. Unshielded twisted pair, non polarity sensitive connection to controller
 - h. RJ-45 jack for network access via PC.
7. Wall-Mounted Combination Temperature/CO2 Sensor:
- a. Sensor shall be as described for Wall Mounted Sensor with:
 - 1) Supply power voltage 18 – 30 VAC
 - 2) CO2 Measurement Range 0 to 2000 ppm
 - 3) CO2 Output Signal
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Strap-On Pipe-Mounted Temperature Sensor:
- a. Accuracy:
 - 1) Platinum RTD: $\pm 0.6\%$ @ 32°F (0°C);
 - 2) Nickel RTD: $\pm 0.5^\circ\text{F}$ @ 32°F (0°C);
 - 3) Balco RTD: $\pm 0.1\%$ @ 32°F (0°C);
 - 4) Thermistors: $\pm 0.36^\circ\text{F}$ from 32 to 158°F (0 to 70°C).
 - b. Operating Temperature: -32 to 240°F (-35.5 to 115.5°C).
 - c. Probe Material: Copper conductor.
 - d. Mounting: Strap-on to pipe (fits 2 to 5 pipe sizes).
- C. Humidity Sensors: Thermoset polymer capacitive sensor.
1. Accuracy: 2 % over full range with linear output.
 2. Room Sensor Range: 5 to 95% relative humidity, non-condensing.
 3. Wall Mounted Sensor:
 - a. Manufacturer's standard cover, approximately 3"W x 5"H x 1"D, white color, conforming to NEMA-1 requirements. UL listed. Surge immunity compliance with IEEE C62.41.
 - b. No LCD display or keypad, sensor only.
 - c. Separate wiring subbase and electronics.
 - d. Unshielded twisted pair, non polarity sensitive connection to controller
 - e. RJ-45 jack for network access via PC.
 4. Duct Sensor: 20 to 80% relative humidity range with element guard and mounting plate.
 5. Outside-Air Sensor: 20 to 80% relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of -22 to +185°F.
- D. Pressure Transmitters & Transducers:
1. Static-Pressure Transmitter: Non-directional sensor with suitable range for expected input, and temperature compensated.
 - a. Accuracy: 2% of full scale with repeatability of 0.5%.
 - b. Output: 4-20 mA.
 - c. Building Static-Pressure Range: 0-0.25 inches w.g.
 - d. Duct Static-Pressure Range: 0-5 inches w.g.

2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
5. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.

2.4 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- 5-inches w.g.
- B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig piped across pump.
- C. Current Switches and Relays: For status inputs for electric motors shall comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter (20A single phase) or separate relay (contacts rated for 120/240V and appropriate amperage) for higher amperage single phase and three phase motors all within a common junction box, current sensor status, adjustable status trip point, LED status indication lights and suitable for 175 percent of rated motor current.
- D. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- E. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- F. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.5 THERMOSTATS

- A. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
 1. Automatic switching from heating to cooling.
 2. Preferential rate control to minimize overshoot and deviation from set point.
 3. Set up for four separate temperatures per day.
 4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
 5. Short-cycle protection.
 6. Programming based on **every day of week**.
 7. Selection features include °F or °C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
 8. Battery replacement without program loss.

9. Thermostat display features include the following:
 - a. Time of day.
 - b. Actual room temperature.
 - c. Programmed temperature.
 - d. Programmed time.
 - e. Duration of timed override.
 - f. Day of week.
 - g. System mode indications include "heating," "off," "fan auto," and "fan on."
- B. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85°F set-point range, and 2°F maximum differential.
- C. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85°F set-point range, and 2°F maximum differential.
 1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
 2. Selector Switch: Integral, manual on-off-auto.
- D. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
 1. Bulbs in water lines with separate wells of same material as bulb.
 2. Bulbs in air ducts with flanges and shields.
 3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
 4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
 5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
 6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.
- E. Room Thermostat Cover Construction: Manufacturer's standard locking covers.
 1. Set-Point Adjustment: Exposed
 2. Set-Point Indication: Exposed
 3. Thermometer: Exposed
 4. Color: White
- F. Room thermostat accessories include the following:
 1. Insulating Bases: For thermostats located on exterior walls.
 2. Thermostat Guards: Locking; heavy-duty, transparent plastic; mounted on separate base. Locking, solid metal, ventilated.
 3. Adjusting Key: As required for calibration and cover screws.

4. Set-Point Adjustment: 1/2-inch diameter, adjustment knob.
- G. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.
- H. Air stream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
- I. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
 1. Bulb Length: Minimum 20 feet.
 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- J. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
 1. Bulb Length: Minimum 20 feet.
 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

2.6 ACTUATORS

- A. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 1. Manufacturers: Belimo Aircontrols (USA), Inc.
 2. Listing: Actuators shall have ISO 9001 quality certification and be UL listed under standard 873.
 3. Characteristics: Actuators shall be fully modulating/proportional, pulse width, floating/tri-state or two-position as required and be factory or field selectable. Each actuator shall have visual position indicators. Proportional actuators shall accept a 0-10VDC or 0-20mA input signal with 2-10VDC and 4-20mA operating range, respectively. Actuators shall be capable of operating on 24, 120 or 230VAC or 24VDC and Class 2 wiring as required by the application. Power consumption shall not exceed 10VA for 120V actuators and 8 watts for DC actuators. Actuators shall be capable of being mechanically and electrically parallel to increase torque, if required.
 4. Fail-Safe Operation: Mechanical, spring-return mechanism shall be provided on all dampers and valves except where noted otherwise. Provide external, manual gear release on non-spring return actuators.
 5. Valves: Size for torque required for valve close off at maximum pump differential pressure plus 25% safety factor.
 6. Dampers: Size for running torque calculated as follows:

- a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
 - e. Dampers with 2- to 3-Inch w.g. (of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch w.g. of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
 - g. Coupling: V-bolt and V-shaped, toothed cradle.
7. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 8. Run Time: 12 seconds open, 5 seconds closed.

2.7 CONTROL VALVES

- A. Control Valves: Factory fabricated, of type, body material, and pressure class based on fluid system, maximum pressure and temperature rating of piping system, unless otherwise indicated.
- B. Valves shall be equipped with a manual positioner to allow positioning of the valve in the absence of power.
- C. Sizing – Hydronic system control valves shall be sized as follows:
 1. Two-Position: Line Size
 2. Two or Three Way Modulating: 10 ft.hd. water pressure drop or as otherwise noted on the plans.
- D. Ball Valves 2” and smaller – Air Terminal Units
 1. Body:
 - a. Cast Bronze or Brass
 - b. ANSI B16.5 Class 150
 - c. Threaded or soldered pipe connection
 2. Trim:
 - a. Stem: Stainless Steel
 - b. Ball: Stainless with an equal percentage flow characteristic or modified equal percentage flow characteristic for 2-way, linear for 3-way.
 3. Bonnet
 - a. Brass
 - b. Packing: Reinforced Teflon or carbon filled Teflon and EPDM O-Ring.
 - c. Seat: Reinforced Teflon or carbon filled Teflon.
- E. Globe Valve 2” and Smaller – AHU’s only
 1. Body
 - a. ANSI B16.5 Class 125 and 250
 - b. Cast Bronze or Brass
 - c. Threaded (FNPT), union sweat, or flared connections

2. Bonnet
 - a. Brass
 - b. Packing: Self-adjusting Ethylene Propylene Rubber (EPR) ring pack u-cups, spring loaded PTFE and Elastomer v-rings, or spring loaded Teflon cone.
 3. Brass Trim
 - a. Stem: Stainless Steel
 - b. Plug: Brass, equal percentage flow characteristic or modified equal percentage flow characteristic.
 - c. Replaceable Seat: Brass against molded Elastometric disc, or bronze.
 4. Stainless Steel Trim (Steam Applications)
 - a. Stem: Stainless Steel
 - b. Plug: Brass, equal percentage flow characteristic or modified equal percentage flow characteristic.
 - c. Replaceable Seat: Stainless Steel.
- F. Globe Valves 2.5” and Larger – AHU’s only
1. Body
 - a. ANSI B16.5 Class 125 and 250
 - b. Cast Iron with black lacquer finish
 - c. Flanged Connections
 2. Bonnet
 - a. Brass
 - b. Packing: Ethylene Propylene Terpolymer (EPT) ring packs, EDPM O-ring, or spring loaded Teflon cone.
 3. Trim
 - a. Stem: 316 Stainless Steel
 - b. Plug: Brass, equal percentage flow characteristic or modified equal percentage flow characteristic.
 - c. Replaceable Seat: bronze.
- G. Pressure-Independent Valves
1. Body
 - a. Brass rated at no less than 360 psi at 250 deg F.
 2. Bonnet
 - a. Brass
 - b. Packing: Reinforced Teflon or carbon filled Teflon and EPDM O-ring.
 3. Trim
 - a. Stem: Brass or Stainless Steel
 - b. Ball: Plated brass or Stainless Steel, equal percentage flow characteristic or modified equal percentage flow characteristic for 2-way, linear for 3-way.
 - c. Disc: Thrust-bearing Teflon disc with double O-ring design.
 - d. Seat: Reinforced Teflon or carbon filled Teflon with EPDM O-rings

- e. Packing: EPDM O-ring.
- H. Close-off Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings.
 - 1. Water Valves:
 - a. Two-Way: 150% of total system pump head.
 - b. Three -Way: 300% of pressure differential between ports A and B at design flow rate or 100% of total system pump head.

2.8 DAMPERS

- A. Dampers: AMCA-rated, parallel and opposed blade design as required by the application.
- B. Outside air and relief air dampers (exposed to outside air) shall be severe cold option design with the following features:
 - 1. Frame: Extruded aluminum, 4" x 0.08" thickness with polystyrofoam insulation.
 - 2. Blades: Extruded aluminum, double wall profile with expanded polyurethane foam insulation filled cores and thermally broken. Insulation factor of R-2.29
 - 3. Seals: Blade and frame edge seals are extruded silicon, secured in an integral slot.
 - 4. Bearings: Celcon inner bearing fixed to a 7/16" aluminum hexagonal blade pin, rotating within a polycarbonate outer bearing without metal-to-metal or metal-to-plastic bearing contact.
 - 5. Linkage: Hardware mounted within the frame, aluminum and zinc plated steel construction.
 - 6. Operating temperature: -40 to 155°F.
 - 7. Leakage: 4.9 cfm/sq. ft. at 4" w.g., maximum
- C. Return and other control dampers not exposed to outside air shall be constructed with the following features:
 - 1. Frame: Extruded aluminum, 5" x 0.125" thickness.
 - 2. Blades: Extruded aluminum, airfoil profile.
 - 3. Seals: Blade seals shall be extruded EPDM. Frame seals shall be extruded TPE thermoplastic, secured in an integral slot.
 - 4. Bearings: Molded synthetic
 - 5. Linkage: Hardware mounted within the frame, aluminum and zinc plated steel construction.
 - 6. Operating temperature: -72 to 275°F.
 - 7. Leakage: 3 cfm/sq. ft. at 1.0" w.g. max.

2.9 AIR FLOW MEASURING STATIONS

- A. The probe assembly shall consist of one or more electronic air flow measuring units capable of continuously monitoring airflow. Each probe shall contain multiple electronic flow sensors and be thermal dispersion type. They shall be mounted in an array format to produce a true velocity profile. The sensors shall operate over a 350 to 7500 fpm velocity range and the velocity

measured by each sensor shall output a signal directly proportional to flow to the supporting electronics. The output signal shall be fully isolated. The signal transmitter shall be an electronic device capable of receiving airflow probe signals over the probe interconnecting cables, linearizing each signal and them summing and averaging them. Finally the signals shall be converted to a 4 to 20 MA output signal for automatic transmission to any suitable remote input and/or recording device. A 24 volt AC power supply is required for each transmitter. The control panel shall be provided with integral diagnostics including on-line zero and on-line sensor verification. It shall have an integral reference standard for field calibration of transmitter output. The output span shall be adjustable from a minimum 0 to 1000 to a maximum 7500 fpm. The transmitter assembly shall be housed in a metal enclosure having a hinged door and lock. This unit shall not require recalibration. System accuracy shall be +/- 2% of rate plus +/- 0.55 of full scale.

1. Each supply and return fan shall have an independent air flow measurement station. Multiple fan arrays shall sum flow of each fan to report a total fan array air flow.

B. Air flow measuring station shall be manufactured by:

1. Ebtron
2. Paragon Controls

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify location of wall mounted sensors with drawings and room details before installation. Install devices to match rough in height of light switches provided by the Electrical Contractor, Coordinate location and placement with other wall mounted devices, cabinets, etc.
- B. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- C. Install guards on thermostats in the following locations:
 1. Entrances.
 2. Public areas, such as lobbies.
 3. Corridors.
 4. Large conference rooms.
 5. Where indicated on drawings.
- D. Automatic dampers shall be furnished by the controls subcontractor to the HVAC Contractor for installation in accordance with Section 23 3300 "Air Duct Accessories."
- E. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- F. Damper linkages shall be through frame hardware; linkage attachments to blades are not acceptable.
- G. Damper jack shafting is not permitted, provide an actuator for each damper section.

- H. Install labels and nameplates to identify control components according to Section 23 0553 "Identification for HVAC Piping and Equipment."
- I. Install hydronic instrument wells, valves, and other accessories according to Section 23 2113 "Hydronic Piping."
- J. Install refrigerant instrument wells, valves, and other accessories according to Section 23 2300 "Refrigerant Piping."
- K. Install duct volume-control dampers according to Section 23 3300 "Air Duct Accessories" specifying air ducts.

END OF SECTION 23 0913

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SECTION 23 0914 – CONTROL WIRING AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control wiring, both line and low voltage, transformers, power distribution, fusing and panels, power filtering and communication cabling which is required to perform the automatic control functions described.
- B. Related Sections:
 - 1. 23 0913 Instruments and Control Devices
 - 2. 23 0923 Direct Digital Control System

1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Wiring, both line and low voltage, shall comply with NEC and shall be subject to approval by the local code enforcing authorities.
- C. Wire, conduit and installation methods shall conform to applicable provisions of Division 26 - Electrical except that wiring smaller than No. 12 and conduit smaller than 3/4" are permitted as appropriate for the application.
- D. Communication cabling shall conform to applicable provisions of Division 27- Section "Communications Horizontal Cabling".
- E. All wiring and cabling insulation in air return plenums shall not exceed maximum flame spread rating of 25 and smoke development rating of 50 as established by NFPA 255 test methods.

PART 2 - PRODUCTS

- A. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
 - 1. Output ripple of 5.0 mV maximum peak to peak.
 - 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 - 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

- B. Power Line Filtering: Provide internal or external transient voltage and surge suppression for workstations or controllers with the following:
 - 1. Minimum dielectric strength of 1000 V.
 - 2. Maximum response time of 10 nanoseconds.
 - 3. Minimum transverse-mode noise attenuation of 65 dB.
 - 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.
- C. Power distribution, fusing and panels:
 - 1. Power distribution transformers, fuses, termination strips etc. shall be organized in NEMA 1 enclosure panels. Panels shall be 16 gauge steel construction, with removable front cover and various size removable knockouts, arranged for surface mounting and polyester powder coat finish inside and outside, UL listed. Arrange and bundle wiring inside of panels neatly with cable ties. Panel and internal devices shall be permanently marked to correspond to power wiring diagram shop drawings provided in the operating and maintenance manual.
- D. Cabling:
 - 1. Provide CAT 5E Ethernet fiber optic cabling to interconnect major controllers and work station computer or Web server to establish the primary network configuration as determined by the direct digital control system architecture. Provide excess cabling at each connection for servicing by looping cable near the panel.
 - 2. Secondary LON or BacNet MS/TP bus wiring to secondary controllers such as unitary controllers serving VAV boxes shall be as required by the communication protocol.
 - 3. All cabling insulation shall be approved and labeled for use in air plenums where installed in these locations.

PART 3 - EXECUTION

3.1 ELECTRICAL POWER SUPPLIES

- A. The Electrical Contractor will provide a power source to motors through his starters only. Where power sources are required beyond these starters, or beyond sources explicitly shown on the electrical drawings, these shall be provided by the Controls Contractor. Where auxiliary contacts are required on starters to perform the required functions, these too shall be provided by the Controls Contractor, where not provided under the Electrical Contract. Auxiliary relays maybe provided in lieu of auxiliary contacts.
- B. Electrical circuits serving direct digital or electronic control panels, transformers and other control equipment and devices shall be from the nearest appropriate emergency electrical panel. Coordinate with the Electrical Contractor.
- C. Circuits serving control panels and transformers for low voltage service shall be independent and used for no other purpose. These shall originate from the nearest appropriate emergency electrical panel. Circuit wiring from the electrical panel shall be included in this contract. These circuits shall be clearly identified at the panels.

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install all work in accordance with the following:
1. All wiring to be ran in a neat, workmanlike manner. All wiring to be tie wrapped or in conduit as per specifications. Wiring or conduit to be ran parallel or at right angles to building structure. Install all wiring free of sags. Bundle wiring together that follows a common path.
 2. All conduit, plenum wiring, and panels shall be supported directly from the building structure with beam clamps and bridle ring. Do not support from pipe, pipe hangers, threaded rod, ductwork, ductwork strapping or other conduit.
 3. Do not lay conduit or plenum wiring on acoustic ceiling tiles, grid members or uninsulated water piping. Conduit and wiring should be installed in such a way as to not interfere with removing ceiling tiles for above ceiling access.
 4. Do not run wiring near lighting ballasts or other high voltage devices that could cause interference.
 5. All line voltage wiring must be kept separate from low voltage wiring. Line and low voltage wiring may not be run in the same conduit. Line and low voltage wiring must be kept separate in control panels.
 6. Label all wire jackets at control panel/controller and at device with tag as shown on wiring details and flow diagrams.
 7. Observe proper polarity as shown on wiring diagrams when connecting 24VAC power and ground controllers and other devices. Note that all transformer secondary grounds must be tied to chassis ground as shown in wiring diagrams unless otherwise noted.
 8. Coordinate with General Contractor and all trades to perform rough-ins for temperature control sensors and devices.
 9. Coordinate with General Contractor and all trades to confirm mounting locations for temperature control panels.
 10. Completely seal all duct, unit and wall penetrations. Avoid ceiling penetrations if at all possible. Completely seal any ceiling penetrations that are absolutely necessary.
 11. All network communication wires shall be labeled at each controller with the designation or the controller that the communication wire originates from and terminates to
 12. Verify network communications and correct any issues.
 13. Clean all construction debris from inside temperature control panels before operation.
- B. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."
- C. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." All line voltage wiring and low voltage wiring (except as stated below) shall be run in conduit. Open wiring dropping into walls shall be run in conduit. Thermostats shall be installed on a single gang box and conduit shall be installed to extend into the plenum. Open wiring shall be bundled and supported at 3 ft. maximum intervals with a system of J-hooks or equivalent means. Open wiring in air plenums shall be rated for such use and so labeled.

END OF SECTION 23 0914

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SECTION 23 0923 – DIRECT DIGITAL CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. A complete system of computer based, direct digital automatic temperature controls shall be installed under this contract as required to accomplish the sequence of control for various items of equipment and systems indicated on the drawings and as specified in Division 23.
- B. Direct Digital Controls (DDC) upgrade for the existing building controls is part of the scope of work. Refer drawings for systems sequence of operations. Controllers, system architecture, communication cabling and network, software, graphics, etc. shall be seamlessly integrated as part of the new system.
- C. This Section includes Direct Digital Control (DDC) components, including operator work station, controller/server, equipment specific and generic controllers, I/O interface, software and graphics.
- D. See Sections 23 0913 “Instruments and Control Devices”, Section 23 0914 “Control Wiring and Cabling” and Section 23 0993 “Sequence of Operations for Controls” for requirements that relate to this Section.

1.2 SUBMITTALS

- A. Product Data: For all hardware and software.
- B. Shop Drawings:
 - 1. Schematic air and fluid flow control diagrams, sequence of operations descriptions and points list.
 - 2. Power, wiring diagrams.
 - 3. DDC System Hardware components, including controllers, actuators, sensors, valves, dampers, cabinet enclosures, etc.
 - 4. Control System Software
 - 5. Graphics- screen examples specific to the project for AH unit, VAV box, hot water system and chilled water system.
- C. Software and firmware operational documentation.
- D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Each control subcontractor must be an authorized temperature control contractor in the business of installing and servicing direct digital temperature control systems for over five (5) years. The

bidder must have installed and successfully completed at least ten (10) DDC systems of similar size using the same hardware that is proposed.

- B. Subcontractor installation and service office must be located within 75 miles (90 minute travel time maximum) of the building site.
- C. Design and installation of the digital control system shall be performed by employees trained and certified by the equipment supplier. Electrical power work other than low voltage shall be performed by licensed electricians.
- D. The temperature controls subcontractor shall provide all necessary engineering support for a complete and functional system, including but not limited to engineering, programming, installation, supervision, commissioning and troubleshooting.
- E. Refer to 23 0801 Mechanical Systems Commissioning.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 CONTROL SYSTEM

- A. Contractors:
 - 1. Honeywell International Inc Authorized Controls Integrator (ACI) (local authorized contractors only, branch office is not acceptable)
 - 2. Schneider Electric (TAC, Invensys) – I/A Series
 - 3. BuildingLogiX
- B. Complete DDC system shall consist of operator workstation, sensors, indicators, actuators, final control elements, interface equipment, wiring, cabling, power supplies and power distribution, other apparatus, accessories, software and graphics connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems as specified here and in related Division 23 Sections.

2.2 LICENSING AGREEMENT AND OPEN PROTOCOL

- A. A true Open Licensing Agreement shall be provided and executed with the Owner to permit total and open access to the system for servicing and software revisions by other qualified servicing contractors.
- B. The supplied system must incorporate open protocol with the ability to access all data using Java base Web enabled browsers without requiring proprietary operator interface and configuration programs.
- C. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a

server. Proprietary database and user interface programs are not acceptable (except for unitary controllers as noted below).

- D. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-1995, BACnet and LonMark to assure interoperability between all present and future system components is required.
- E. Proprietary programming shall not be utilized. In addition, all required programming software and graphics shall be embedded in the server or controllers without the need for external software to execute queries or revisions. All graphics shall reside in the server. Remote access via LAN or Web shall not require external software to provide complete access to all data, graphics, alarms, programming, etc.

2.3 DDC ARCHITECTURE

- A. DDC system shall be complete with an Operators Workstation/Server, Configurable Controllers, Unitary Controllers, required I/O modules for controller expansion, communication cards in controlled devices such as chillers, variable frequency drives (furnished with the equipment, coordinate card requirements), arranged for a completely integrated building automation system network.
- B. Physical connection of BACnet network controllers shall be via Ethernet/Ethernet IP using the Owner's Local Area Network (LAN).
- C. Where data drops are not shown for the Configurable Controllers or Operator Station/Server, the temperature control subcontractor shall be responsible to provide the IP data drop to each network controller location for controller connectivity. Installation shall be subcontracted to the division 27 technology contractor; coordinate connection requirements. In addition, provide an additional IP data drop to each controller, or group of controllers to provide local access to data acquisition for the HVAC service technician.
- D. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.
- F. DDC system accessibility over the LAN or the Internet shall be user name and password protected. Provide separate user name/password for multiple level hierarchy to restrict access to appropriate personnel at the different levels (view, programming, etc.). The system must be set up to have at least 3 access levels: guest, user and administrator. Guest privileges shall be limited to view only. Users shall be able to make setpoint and schedule changes. Administrators shall have all privileges as users in addition to being able to assign passwords.

2.4 OPERATOR WORKSTATION/SERVER

- A. An operator workstation/server shall be provided to effectively program, manage and access DDC information from all of the controllers. Interface shall utilize dynamic color graphics of each mechanical system, building floor plan, and control device depicted by point-and-click graphics.
- B. All DDC information shall be accessible through the server over the LAN as well as over the Internet via Ethernet IP.
- C. Operator Workstation/Server Computer: Equal to Dell Studio XPS 630.
- D. Minimum Requirements (or equivalent):
 - 1. Processor: Intel Core 2 Duo.
 - 2. Ports/Jacks: (6) USB 2.0, (2) IEEE 1394a, headphone, microphone, 19-1 media reader, (1) RJ-45, 2.1 audio, S video in/out, S/PDIF optical
 - 3. Random-Access Memory: 2GB Dual Channel DDR2 SDRAM.
 - 4. Monitor: 20" wide screen, WSXGA resolution, 5ms pixel display rate, 720p high definition display flat panel.
 - 5. Graphics: Intel GMA 3100
 - 6. Hard-Disk Drive: 160 GB .
 - 7. 48X combo optical drive.
 - 8. Communications: Integrated Gigabit Ethernet (10/100/1000Base-T), internal WiFi 802.11 a/b/g/n Draft 2.0
 - 9. 10W Stereo Speakers
 - 10. Operating System: Microsoft Windows
 - 11. Keyboard.
 - 12. Mouse: Three button, optical.
 - 13. Six outlet surge protector.
 - 14. Printer: Laser jet type, B&W, 8Mb RAM equal to HP LaserJet 1022
 - 15. Workstation desk and chair will be provided with loose furnishings by others.
- E. The server shall provide integrated control, supervision, data logging, alarming, scheduling and network management functions. The controller/server provides the Internet connectivity and Web serving capabilities, presenting real time information in Web based, rich graphical displays for the system. Application control programs to provide: Calendar functions, Scheduling, Trending, Alarm monitoring and routing, and Time synchronization.
- F. Proprietary programming shall not be utilized. In addition, all required programming software shall be embedded in the server or controllers without the need for external software to execute queries or revisions. All graphics shall reside in the server. Remote access via LAN or Web shall not require external software to provide complete access to all data, graphics, alarms, programming, etc.
- G. The server shall support standard Web browser access via the Intranet/Internet.
- H. Provide and maintain an Audit Log that tracks defined activities on the system. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached a user-defined buffer size. Archive the log locally. For each log entry, provide the following data: Time and date, User ID, Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

- I. The controller/server shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval. Copies of the current database and the most recently saved database shall be stored in the server. The age of the most recently saved database is dependent on the user-defined database save interval. The controller/server database shall be formatted to allow for user viewing and editing, if desired.

2.5 CONFIGURABLE CONTROLLERS/SERVERS

- A. Individual configurable controllers shall be provided for each central HVAC equipment or system (AH unit, boiler, chiller, etc.). Distributed HVAC equipment, such as air control box terminals, fan coils, unit heaters, etc may utilize local, unit specific controllers.
- B. Controllers shall be capable of functioning in either a standalone capacity or integrated into the building network.
- C. Controllers shall be fully configurable type with both control and server capabilities including integrated control and management of external devices, supervision, data logging, alarming, scheduling, network management functions, Internet connectivity, web serving. The controller shall include software technology capable of integrating a variety of devices, interoperable networks and protocols such as LonWorks, BACnet, ModBus, etc into a seamless operating platform.
- D. The controllers shall be expandable by the use of input/output I/O modules to provide additional points beyond resident points provided on the controller module.
- E. Each configurable controller shall include the following minimum hardware features. Where required for functionality provide additional communication cards, memory cards or I/O modules: Two (2) Ethernet Port -10/100 Mbps, One (1) RS-232 port, One (1) RS-485 ports (BacNet MS/TP), LON Tunnel service, BACnet driver (Ethernet and Ethernet IP), One LONWorks Interface Port with driver – 78KB FTT-10A, Power Supply 24V power supply module, Battery Backup, 64 Mb flash memory for long term data backup and 64 Mb RAM.
- F. I/O modules shall connect to the controller with a single multi pin plug, powered through the controller with a minimum of eight (8) universal inputs, four (4) analog outputs and four (4) relay outputs, Form A contacts. Do not exceed maximum I/O modules recommended by the manufacturer.
- G. The controller/server must be capable of operation over a temperature range of 0 to 50°C and storage temperatures of between 0 and 70°C. The controller/server must be capable of operation over a humidity range of 5 to 95% RH, non-condensing.
- H. The controller/server shall support standard Web browser access via the Intranet/Internet.
- I. Where acting as a server, provide and maintain an Audit Log that tracks all activities performed on the controller/server. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached it's user-defined buffer size. Provide the ability to archive the log locally (to the controller/server), to another controller/server on the

network, or to a server. For each log entry, provide the following data: Time and date, User ID, Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

- J. The controller/server shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval. Copies of the current database and, at the most recently saved database shall be stored in the controller/server. The age of the most recently saved database is dependent on the user-defined database save interval. The controller/server database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.
- K. Controllers shall be fully programmable with “drag and drop” graphic representations of control algorithms and easy to use “wizards” that automate controller configurations.
- L. Controllers shall be “Native” BacNet devices with interoperable native BacNet, IP, LON and MS/TP communication support.
- M. Each controller with I/O modules shall include input/output capabilities with, as a minimum, sufficient universal inputs, digital inputs, universal outputs and digital outputs to perform the required function and include an additional spare two (2) universal inputs, (2) analog outputs and two (2) relay outputs for future upgrade capability (spare points are not required for unitary controllers).

2.6 UNITARY CONTROLLERS

- A. Controller designed specifically for VAV reheat box terminal units, fan coil, unit heater, etc., shall be used for each distributed HVAC equipment item. Local controllers shall be capable of functioning in either a standalone capacity but shall be integrated into the building network.
- B. Use of a dedicated network with a proprietary communication protocol that is compatible for integration into the configurable controllers is acceptable provided the unitary controllers use true peer to peer communication for all devices, the communication network uses simple non polarity sensitive twisted pair wiring and the network provides for interoperability between devices and controllers such as Echelon LonWorks is acceptable.
- C. For VAV reheat box terminal units:
 - 1. The controller shall include where required a digital communications to wall sensor, velocity pressure pneumatic input via polyethylene tubing for supply air flow reading, supply air sensor, flow balancing software (damper adjustment, set point monitoring and adjustment, flow validation and calibration, sequence/calibration/control set point logs)
 - 2. Damper actuator shall be separate from the VAV reheat box controller; integrated controller/actuator devices are not acceptable.
 - 3. The remote wall sensor shall include a communication jack for connecting a laptop to the box controller for air/water balance purposes.
 - 4. Integral controller/damper actuator is acceptable.
- D. Controllers used for remote temperature and humidity sensing, adjustment and override such as VAV box controllers and fan coil units shall include S-link communication via two wire,

unshielded cable (non polarity sensitive) to provide power and communication interface for remote sensors.

2.7 CONTROLLER ENCLOSURE AND LISTING

- A. Controllers shall be placed within enclosures that conform to NEMA-1 construction and shall further meet UL 94-5V flammability ratings for plenum application use.
- B. Each controller shall be UL-916 listed and meet FCC Part 15 Class A.

2.8 GUI DISPLAY FRAMES

- A. The system must be set up to have at least 3 access levels: guest, user and administrator. Guest privileges shall be limited to view only. Users shall be able to make setpoint and schedule changes. Administrators shall have all privileges as users in addition to being able to assign passwords.
- B. Each AHU, heating water system and cooling system shall have a minimum of 5 graphic screens available from the tree view. One screen shall display the airflow pattern with all dampers, coils and fans shown in their correct schematic location and dynamic data for all input values shown. This main graphic screen shall show the control devices in mechanical flow diagram format with directional arrows to indicate normal flow arrangement. These screens shall be available to anyone with access to the system, and therefore shall be view only. Another screen shall display text information with the following primary categories: Unit status, temperatures, heating, cooling, economizer, static pressure, supply fan, exhaust fan including setpoints. A loop tuning screen shall also be furnished for each control loop, so that people with the appropriate access can change loop tuning parameters from PCs without needing individual programming tools. Override screens shall be furnished for each controller to permit overriding control points without the need for vendor specific software. An alarm screen shall also be furnished each AHU. The Heating systems and Cooling systems shall have similar screens as the AHUs. Each VAV shall have a graphics screen and a text screen. Systems that won't permit creating these customized screens as described herein will not be acceptable. Systems that use controllers that won't permit overrides of inputs and outputs from a browser based graphic screen will not be acceptable.
- C. All shapes shall be 3-D with a common perspective. All dampers shall have a minimum of 4 animation levels to show partially open, half open, mostly open, fully open, and closed position of dampers. All analog inputs shall show the actual value and engineering units on the graphic screen. Binary inputs shall be linked to flashing animated displays. Safety alarms will flash when in alarm. Filter status shall be indicated when value indicates that they are dirty. To prevent clutter on the graphic displays, symbols will only be shown for equipment that is controlled or monitored by the DDC system. Also, normal status for safeties will not be indicated, and normal status for safeties will be indicated by an image of a clean filter. Pumps and fans shall rotate when flow is proven by a monitoring device. Coils shall change color when valves are open to permit water flow through the coils.

- D. Graphics shall use common color schemes to make the overall system easy to understand. All overall backgrounds shall be white. All text shall be black. Any value that is in alarm shall have a red background. Any value that is overridden shall have a blue background. All like sensors shall be the same color. For example, all temperature devices shall be yellow, all pressure devices shall be purple, all humidity devices shall be teal, all fire alarm devices shall be red, and all CO2 devices shall be green.
- E. Current setpoints and occupancy status shall be shown at the bottom of each graphic screen.
- F. Floor plan drawings shall be provided, and permit access to each zone's individual floor plan sections. On the individual floor plan sections, room numbers and room temperatures shall be displayed. Values that are out of the acceptable range shall appear in a different background color and / or flash. Each VAV shall have its own graphic that contains the points from within its controller including the box flow setpoint, room temperature setpoint, maximum cooling flow setpoint, minimum cooling flow setpoint, and minimum heating flow setpoint, plus the discharge air temperature from the AHU supplying the unit. The VAV text screen shall have the same information as the graphic screen plus high and low flow calibration values, damper rotation adjustment (CW or CCW), and air balance set-up features. GUI shall permit operator the ability to enable, set or disable high and low occupied and unoccupied limits for each room temperature reading.
- G. Text Screens shall be available for all levels of access. Setpoint and output values are changeable from the text screen for users with appropriate access privileges and administrators, but not guests. When a value can be overridden or edited, a red box shall appear around it when the cursor is position on it. A single click of the mouse shall bring up pop up menu that provide options to make a permanent override, change setpoint, or release a previous override of an output point. Analog inputs shall have pop up menus that allow setting high and low alarm limits and the ability to enable and disable alarm limits as appropriate for the sensing device. Pop up menus must be customized to include a description of the point that is being modified. Generic override menus are not permitted because they would not describe to an operator what is about to be modified. The Control Contractor shall set up all initial alarms as indicated in the point matrix.
- H. Text screens shall include schedule information including current state and date and time of next scheduled event. Positioning the mouse over the current state shall permit single click access to the schedule. The schedule screen shall allow the operator to edit a yearly, weekly, daily, holiday or special event schedule for the system being viewed. Temperature values and setpoints shall be displayed below the schedule information, and shall have a minimum of 1 decimal place. Heating, cooling and damper outputs shall be displayed next. The OA temperature for economizer switchover shall be displayed and adjustable from the text screen. Air flow readings shall be shown with setpoint and actual readings. Fan information shall be shown next, followed by static pressure readings and setpoints, which shall have a minimum of 2 decimal places. Miscellaneous setpoints including night setback cooling and heating, average zone temperature, return air warm-up and cool-down, dehumidification, and unoccupied mixed air temperature setpoints shall all be shown and adjustable. All safeties shall be shown, followed by coil pump control information.
- I. Each system shall have its own specific alarm screen available to all operators but only editable by operators with user and administration access privileges. From the alarm screen, users and administrators shall be able to enable and disable alarms. Points that are in alarm shall have an

alarm symbol highlighted in red. Points that are not in alarm shall be shown in gray. Alarms that are disabled shall have a way to indicate this on the alarm screen graphic.

- J. Loop tuning screens shall be available through the web browser interface to save the owner the cost and time associated with using vendor specific software for tuning loops. Access to these screens shall not be provided to guests. Air handling units shall have dedicated screens for discharge air temperature, static pressure, and outside air control loops. Loop tuning screen for discharge air temperature shall include the discharge air temperature, discharge air temperature setpoint, cooling loop throttling range, I-gain and ramp time, heating loop throttling range, I-gain and ramp time, economizer loop throttling range, I-gain and ramp time, unoccupied heating loop throttling range, I-gain and ramp time, cooling valve output, heating valve output, and damper control output. Screens shall also have graphs that show 5 minutes of live data for the discharge air temperature, setpoint, cooling valve, heating valve and mixed air dampers. Each loop tuning screen shall include the appropriate throttling range, I-gain and ramp time.
- K. Each non-unitary controller shall have an override screen. These screens shall be available on-site for use during point-to-point check-out and commissioning. The override screen shall show the inputs and outputs for each controller with the points in their wired location. Unused points shall be shown as spares. Points that are in alarm shall have a red background, and points that are overridden shall have a blue background just as on other screens. These screens shall show the actual values that come back from the controller, not the values that may have been typed in for override at the GUI if the controller software is not accepting the override value. The override screen shall also permit timed overrides.
- L. Each AHU shall also have an overview screen listing every VAV terminals data in a text format that includes occupancy mode, room temperature, room setpoint, box flow, flow setpoint, temperature leaving VAV terminal, % cooling and % heating. Also, each VAV AHU shall have an air balance screen that will permit balancing the system through a computer connected to the Ethernet or directly to the appropriate BC without vendor specific software. The air balancing screens shall permit at least 8 manual override commands: normal, position (%), flow value, flow percent, open, close, min flow, and max flow.
- M. Heating systems and cooling systems with multiple pieces of equipment such as pumps with lead-lag control shall display which device is lead and when the other device will become lead on the text screen.
- N. Although only one outside air temperature sensor is needed per building, the GUI shall use independent outside air temperature points, so that during check-out and commissioning, the outside air temperature for a system can be changed without changing the outside air temperature for the whole building. The GUI shall also have a global outside air temperature point that can be overridden from the screen for the controller where the point is physically connected. Overriding this outside air temperature value will change it for all systems, except when outside air temperature has been overridden for an individual system.
- O. The system shall allow for the easy development and editing of dynamic graphics. Wizards shall be utilized to assist the operator with their manipulation of the graphic system. The operator shall be able to, through a single mouse function, select between the dynamic display mode and the graphic edit mode for the currently viewed graphic frame, assuming appropriate access level is provided to the operator. Systems requiring multiple mouse or operator keyboard commands to enter the graphic edit mode are not desirable and require thorough definition of steps involved to accomplish function.

- P. Animation of system data shall be provided via graphic elements on the display frames. Standard graphic element library shall be provided to assist the operator with their implementation. The ability to define and add new animated graphic elements shall be provided. As a minimum, the ability to move, size, draw, arrange, align, layer, space, rotate, invert, duplicate, cut, copy, paste, erase any animated element shall be provided. System parameters and setpoints shall be assignable and modifiable by the animated graphic elements, relieving the need for keyboard commands for system manipulation.
- Q. The ability to simultaneously display a dynamic X/Y chart of selected points, shall be provided. The chart shall be an element of the graphic display and shall automatically update with the display data. The chart shall allow for dynamic manipulation to modify the range, rate, and timeframe of view, in both a real-time as well as historical configuration. A minimum of 4 values shall be included on any chart display element. There shall not be a limit to the quantity of chart elements displayed on a graphic frame. Trace colors and X values shall be User configurable. Systems not providing this capability are required to provide an equivalent charting package with the GUI offering.
- R. The ability to provide graphically displayed global scheduling and editing functions shall be provided. The ability to link these functions to the associated equipment or zone frames shall be a standard feature. A calendar shall be provided for display and modification of the SDC time clock functions. The User shall be able to view a daily, weekly, monthly, annual, special or holiday schedule from a defined display frame. A list of served areas shall be displayed on the same screen, this list shall be displayed at all times, pull down menus or other means of accessing these areas shall not be acceptable. The system shall have a master override screen that will allow an operator to change the schedule for every piece of equipment in every building by changing the master schedule.
- S. All analog values shall be trended every 15 minutes. The trend samples shall be saved in the BC for at least 36 hours. Access to trended data shall be available by the single click of a mouse on the analog value. Systems that open other windows and require a selection of the desired data are not acceptable.

2.9 GUI ALARMING

- A. The GUI shall provide, as standard, alarm annunciation of system data. On every display frame, the ability to view, acknowledge, delete and manipulate real-time and historical alarms shall be provided. The ability to provide a unique and custom alarm display for every display frame shall be provided. The ability to continuously or upon request, view the alarm display, shall be provided.
- B. Alarm conditions shall be capable of invoking, as a minimum; a display frame, an email message, a text message sent to a pager or cellular phone.
- C. Alarm logging shall be provided in a user definable configuration. All alarms shall be displayed and/or routed as follows, as a minimum; GUI display frame, local printer, server printer, client printer, logged to file, and archived in standard format for information management. Alarm groupings shall be hierarchical in nature allowing up to 8 alarm groups and 16 sub-groups. The

GUI shall not possess any limits on the quantity of alarms that can be logged, including historical data archiving. Systems possessing limits must define the restrictions and may not be acceptable.

- D. Provide up to 999 alarm priorities with up to 5 alarm color changes, per priority, according to alarm status.

2.10 GUI TRENDING

- A. The GUI shall automatically perform time based, user defined, periodic collection of real time point data. The data shall be presented as an X/Y chart in the display frame. The data shall be stored and archived in a file format that allows for the manipulation and utilization of the data by third party applications.
- B. A dynamic trend shall be defined as a group of at least 4 data points, with a circular buffer of 2000 data points. A historical trend shall be defined as a group of at least 8 data points, with the sampled points limited only by archival disk space. Sampling rates shall be user selectable from instantaneous (one per second) to once a week. Collection of data shall be user selectable to start and stop on a specific time and date. There shall be no limit to the number of X/Y charts within a display frame.
- C. X/Y charting and column and row reporting shall be an integral part of the system. All points shall be chartable or reportable. Analytical data shall be displayed for any of the selected points in a clearly displayed X/Y chart. This analytical data shall consist of at least the following: Average Mean, Standard Deviation, Simple Average, Current Value, Cycle Length, Cycle High and Cycle Low.
- D. X/Y charting shall provide for the following chart manipulation: display, zoom, scroll, centering, pen legend and export to Excel, Text via Dynamic Data Exchange.

PART 3 - EXECUTION

- 3.1 Furnish a complete set of shop drawings showing the kind of control equipment for each of the various systems and their functions, along with indication on the drawing of all original setpoints and calibration values and set up parameters, and sequence of operation and also that of the automation system. These drawings shall be submitted for approval to the Engineer, together with a complete brochure describing the equipment and their function and operation.
- 3.2 The control equipment supplier shall submit a detailed outline of the owner training material for review and comment by the Engineer during the shop drawing phase. The control system training program shall be customized to reflect the systems installed under this contract and shall cover, as a minimum: software navigation (via custom graphics and Windows based icons), system architecture, pass wording and system security features, input/output control functions, alarm functions/acknowledgement, trending/long term reporting, and control component operation.
- 3.3 Upon completion of the project, furnish and turn over to the Owner and Architect (3) complete sets of brochures describing the various items of equipment, their functions and directions for operation and maintenance.
- 3.4 Upon completion of the control system, the Control Contractor shall adjust all components of the system. ATC Contractor shall make all adjustments in the control system required and as directed by the air balance contractor to achieve the desired air balance quantities. All instruments shall be carefully calibrated and each control function shall be demonstrated to function properly, to the satisfaction of the Engineer and the Owner. Provide a complete instruction manual covering the function and operation of all components. At the time of demonstration, each function shall be simulated to insure that controls respond properly to all signals, and the Owner shall be instructed in the proper operation of the system.
- 3.5 In addition to the adjustments and fine tuning, the Contractor shall include as a part of this contract an additional 40 hours of service technician time for work as directed or authorized by the Engineer to make software changes or field adjustments to hardware.
- 3.6 During the first year of operation, after acceptance by the Owner, the Control Contractor shall provide complete service to adjust or assist the Owner in adjusting the equipment to obtain optimum performance from the control equipment and from the heating and air conditioning systems in general. This shall be done without additional expense to the Owner. This work shall include revisions to DDC software programs and controller programs, and all PC front end software upgrades. All software shall be provided to the Owner in disk form, including back-ups of final field programs.
- 3.7 The control equipment manufacturer shall provide instruction and training of the Owner's personnel regarding the hardware and software of the system. Software training shall include programs, methods of programming, control loops, scheduling and reports. Training covering

hardware shall include operation information, functional use, wiring diagrams and schematic diagrams necessary to troubleshoot the operating system. Training shall include “hands on” instructions to completely familiarize Owner’s personnel with the equipment and system. Training of Owner’s personnel shall be equal in scope and detail to that provided by the manufacturer to its service technicians.

3.8 TRAINING

The control equipment supplier shall provide 40 hours of instruction at the job site to familiarize the Owner’s personnel in the application and details of the installed system. Site training classes shall not be scheduled for longer than 4 hours duration except at the discretion of the Owner.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 - 6. Test each system for compliance with sequence of operation.
 - 7. Test software and hardware interlocks.
- C. DDC Verification:
 - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 - 2. Check instruments for proper location and accessibility.
 - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 - 4. Check instrument tubing for proper fittings, slope, material, and support.
 - 5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 - 6. Check temperature instruments and material and length of sensing elements.
 - 7. Check control valves. Verify that they are in correct direction.
 - 8. Check dampers. Verify that proper blade alignment, either parallel or opposed, has been provided.
 - 9. Check DDC system as follows:

- a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

END OF SECTION 23 0923

SECTION 23 0950 – VARIABLE-FREQUENCY MOTOR CONTROLLERS (VFD's)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes solid-state, pulse-width modulated (PWM), variable frequency controllers (VFD's) for speed control of three-phase, squirrel-cage induction motors.
- B. VFD's shall be furnished where noted on the drawings or in the specifications. Provide a VFD for each motor except for supply or return fan wall applications where a single VFD is acceptable when so noted in the AH unit schedule.
- C. VFD's shall be furnished by the HVAC contractor to the Electrical Contractor who will mount the VFD and shall install power wiring required for the installation.

1.2 SUBMITTALS

- A. Product Data: For each type of VFD.
- B. Shop Drawings: For each VFD.
 - 1. Include wiring diagrams.
 - 2. Indicate all accessories required for interface with building automation system for proper operation and control of the motor each drive serves.
- C. Field quality-control test reports.
- D. Operation and maintenance data.
- E. Indicate on the VFD submittals that they have been reviewed and coordinated with the direct digital control system to ensure that all necessary components and accessories are included for proper motor operation and control sequence.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- B. Comply with NFPA 70.
- C. Comply with IEEE Standard 519, Special Applications for Line Notching and Distortion. The manufacturer shall include any additional equipment to meet this requirement, including, AC line filter(s) of the RLC type and/or isolation transformer, or both to meet full compliance.

1.4 COORDINATION

- A. Coordinate features, accessories, inputs/outputs and functions of each VFD and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB (ACH 550 Series).
 - 2. Yaskawa (Z1000 Series).
 - 3. Square D ("S-Flex" Series).
- B. All variable frequency drives required for the HVAC systems shall be from a single manufacturer.

2.2 VARIABLE FREQUENCY CONTROLLERS

- A. Description: NEMA ICS 2, IGBT, PWM, VFD; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
 - 1. Provide unit suitable for operation of premium-efficiency motor as defined by NEMA MG 1.
- B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- C. Output Rating: 3-phase; 6 to 60 Hz.
- D. Unit Operating Requirements:
 - 1. Input ac voltage tolerance of plus or minus 10 percent.
 - 2. Input frequency tolerance of 60 Hz, plus or minus 6 percent.
 - 3. Minimum Efficiency: 96 percent at 60 Hz, full load.
 - 4. Minimum Displacement Primary-Side Power Factor: 96 percent.
 - 5. Overload Capability: 1.1 times the base load current for 60 seconds; 150 percent peak.
 - 6. Starting Torque: 100 percent of rated torque or as indicated.
 - 7. Speed Regulation: Plus or minus 1 percent.
- E. Isolated control interface to allow controller to follow control signal over an 11:1 speed range with input signal type as coordinated with temperature control contractor as applicable.
 - 1. Electrical Signal: 4 to 20 mA at 24 V or 0-10 VDC.

F. Internal Adjustability Capabilities:

1. Minimum Speed: 10 percent of maximum rpm.
2. Maximum Speed: 100 percent of maximum rpm.
3. Acceleration: 1 to a minimum of 600 seconds.
4. Deceleration: 1 to a minimum of 600 seconds.
5. Current Limit: 50 to a minimum of 110 percent of maximum rating.

G. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors.
2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
3. Motor Overload Relay: Adjustable and capable of NEMA ICS 2, 150 percent of rated current.
4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
5. Instantaneous line-to-line and line-to-ground overcurrent trips.
6. Loss-of-phase protection.
7. Reverse-phase protection.
8. Short-circuit protection.
9. Motor overtemperature fault.
10. Power loss ride-thru (2 seconds).

H. Automatic Reset/Restart: Attempts no less than three and no more than five restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.

I. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.

J. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

K. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

L. Input Line Conditioning: As required to comply with IEEE 519.

M. VFD Output Filtering: As required to comply with IEEE 519.

N. Face-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control.

O. Indicating Devices: Meter(s) or digital readout device(s) and selector switch, mounted on face of controller and connected to indicate the following controller parameters:

1. Output frequency (Hz).
2. Motor speed (rpm/Hz/percent, selectable).

3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Elapsed Time Meter (hrs)
7. Fault or alarming status (code).
8. PID feedback signal (percent).
9. DC-link voltage (VDC).
10. Set-point frequency (Hz).
11. Motor output voltage (V).
12. KW.

P. Control Signal Interface:

1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC control systems:
 - a. 0 to 10-V dc
 - b. 4-20 mA.
 - c. Potentiometer using up/down digital inputs.
 - d. Fixed frequencies using digital inputs.
 - e. RS485.
 - f. Keypad display for local hand operation.
3. Output Signal Interface:
 - a. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
 - 1) Output frequency (Hz).
 - 2) Output current (load).
 - 3) DC-link voltage (VDC).
 - 4) Motor torque (percent).
 - 5) Motor speed (rpm).
 - 6) Set-point frequency (Hz).
4. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of any available programmable setting.
5. Embedded communications protocol and interface communications card for LonWorks, BACnet or Ethernet/IP, as required by the temperature control contractor for the direct digital control system provided.

Q. Communications: Provide an RS485 interface allowing VFD to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFD to be programmed via the direct digital control system. Provide capability for VFD to retain these settings within the nonvolatile memory.

R. Drive enclosure shall incorporate an integral motor circuit protector circuit breaker or disconnect switch.

- S. Manual Bypass: Not required except where noted otherwise on the drawings
- T. Isolating Switch: Provide load break switch arranged to isolate VFD from supply source with lock-out provisions.
- U. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

2.3 MULTIPLE MOTOR CONTROL

- A. Where plans/schedules indicate a single VFD for control of multiple motors, the VFD shall be Manufacturer's Model/Series designed for multiple motor application and shall be sized appropriately for the sum of motors Full Load Amps (Horsepower) to be started/controlled simultaneously. The VFD shall include, within its enclosure:
 - 1. Separate, adjustable electronic overload or thermal overload protection for each individual motor to be controlled.
 - 2. Separate, integral motor circuit protector or disconnect switch for each individual motor to be controlled.
 - 3. Separate power terminals for each individual motor to be controlled.

2.4 ACCESSORIES

- A. Historical Logging Information and Displays:
 - 1. Real-time clock with current time and date.
 - 2. Running log of total power versus time.
 - 3. Total run time.
 - 4. Fault log, maintaining last four faults with time and date stamp for each.

2.5 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to VFD (NEMA 1 enclosure) before shipping.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Select features of each VFD to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. Provide complete wiring diagrams for use in interfacing with the equipment. Include these diagrams with the shop drawings.

3.2 INSTALLATION

- A. VFD's will be furnished by the HVAC contractor and turned over to the Electrical contractor for mounting.

3.3 IDENTIFICATION

- A. Identify VFD's, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.4 CONTROL WIRING INSTALLATION

- A. Power wiring between the electrical distribution panel and the VFD as well as the wiring between the VFD and motor shall be installed by the Electrical Contractor.
- B. Control wiring shall be provided by the temperature control subcontractor.
- C. Bundle, train, and support wiring in enclosures.

3.5 FIELD QUALITY CONTROL

- A. Prepare for equipment start up as follows:
 - 1. Test insulation resistance for each supply and feeder circuit. Ensure that leads are not connected to VFD when meggar testing so as not to damage equipment components.
 - 2. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following for equipment start-up:
 - 1. Inspect controllers, wiring, components, connections, and equipment installation. Ensure that all accessories, components, motor control parameters and programming capabilities are available and set for the required control sequence and are coordinated.
 - 2. Coordinate the Manufacturer's Field Service Rep site visit to ensure all interested parties are present for equipment startup and verification of all control and setup parameters.

3.6 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate the operation of the variable frequency drive to the Owner's representative and provide complete instruction and training for the equipment. Demonstration shall include the use of bypass switch where provided, interface and control strategies and basic troubleshooting.

END OF SECTION

SECTION 23 2113 – HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Pipe, Fittings and Joining Methods.
 - 2. Unions and flanges
 - 3. Dielectric Connectors
 - 4. Makeup-water piping.
 - 5. Pipe sleeves, openings, curbing and escutcheons
 - 6. Installation methods of piping
 - 7. Pipe Schedules

- B. Related Sections
 - 1. 23 0523 General Duty Valves.
 - 2. 23 0529 Hangers and Supports.

1.2 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Pipe and fittings for each type utilized.

- B. Shop Drawings: Detail, at 1/4" scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

- B. Welders shall be qualified and fully certified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

- C. Welding procedures and testing shall comply with ANSI Standard B31.1.0 Standard Code for Pressure Piping, Power piping and The American Welding Society Welding Handbook.

- D. Piping between the power boiler (steam boiler above 15 psig) and the valve to valves required in ASME Code, Section 1 shall be in conformance with ANSI B31.1 – Power Piping. Welding shall be performed under PP certification and so stamped.
- E. Safety valves and all pressure vessels shall bear the appropriate ASME label.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS - Refer to Schedule on Drawings

2.2 DIELECTRIC CONNECTORS

- A. A dielectric connector shall be incorporated at each connection between ferrous and copper piping. Connectors shall be:
 - 1. Dielectric coupling with non-conductive polymer liner, Lochinvar Corp. “V-line” Dielectric fitting on services 180 degrees and less.
 - 2. Dielectric flange with non-metallic bolt hole grommets and gasket.
 - 3. Brass adaptor, for HVAC application only.

2.3 PIPE SLEEVES

- A. Schedule 40 black steel pipe or 18-gauge galvanized steel poured concrete floors, walls and roof decks.
- B. Galvanized sheet metal for existing pipes passing thru new walls and partitions (26-gauge)
- C. Combination pre-set floor sleeve and firestopping assembly equal to Hilti CP 680.
- D. Escutcheon plates shall be split-ring chromium plated pressed steel. Plates shall be sized to cover the surface penetration and sleeve. Plates shall be installed on exposed piping in finished rooms and areas where pipes penetrate walls, floors, ceilings, or overhead structure.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Pipe and tubing shall be cut and fabricated to field measurements and run parallel to normal building lines. Pipe ends shall be cut square and ends reamed to remove burrs. The pipe interior shall be cleaned of foreign matter before erection of the pipe.
- B. Piping shall be pitched for drainage. The low points shall be fitted with a ¾” drain valve (with hose thread adapter if not piped to a floor drain) except that on piping 1-1/4” and smaller where

a drain valve is not shown, a drain plug is acceptable. Hose thread adapters on drain valves of potable water piping shall be fitted with a non-removable vacuum breaker.

- C. Piping shall be installed consistent with good piping practice and run concealed wherever possible. Coordinate with other trades to attain a workmanlike installation.
- D. Piping shall be supported as specified in Section 230529 Pipe Hangers. Pipe alignment in both the horizontal and vertical must be tightly maintained. Misalignment must be corrected to the satisfaction of the Engineer before insulation is applied and the system accepted.
- E. Inform the Insulation Subcontractor during the bid period as to the extent of use of mechanical joints so that the sub-contractor can price the work accurately.
- F. Internals of sweat end valves shall be removed when damage or warping could occur due to applied heat of soldering. Where silver brazing is specified, solder connection of valves shall be used to reduce the danger of damage.
- G. Piping within 2 ft. of the coil connections to small heating and/or cooling units, reheat box coils and duct coils may be Type "L" soft copper to facilitate connection in a confined space. Joints shall be brazed or soldered consistent with the piping system or flared-tubing fittings may be used where appropriate.
- H. Close open ends of piping during installation to keep interior of the pipe clean.
- I. Piping shall not be run above electrical switchgear or panelboards, nor above the access space in the immediate vicinity of the equipment, in accordance with N.E.C. Article 384.
- J. Bulb wells for temperature sensing specified in the Controls and Instrumentation Section shall be furnished by the Control sub-contractor and installed by the Piping Contractor. Other types of control devices (differential pressure switches, flow meters, etc.) shall also be installed by the Piping Contractor. Devices, fittings (tees, weldolets, threadolets), locations and installation details shall be closely coordinated with the Controls sub-contractor and device manufacturer's instructions.
- K. Automatic control valves shall be furnished by the Controls sub-contractor for installation by the HVAC piping contractor. Flare fittings for flare end valves shall be provided by the HVAC piping contractor.
- L. Drawings (plans, schematics and diagrams) indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, pipe expansion, pump sizing and other design considerations; therefore, it is imperative that piping be installed as indicated.
- M. Air vents shall be installed at high points of piping and system, on each heating coil and cooling coil and at other locations subject to air binding. Air vents shall be installed in locations accessible for servicing. A shutoff valve or cock on the inlet and drain tubing extending to a drain is required for each large capacity automatic vent. The drain tube shall be extended to a drain location (floor drain, janitor sink, etc.) or, in mechanical rooms, turned down over a clear area of the floor to afford notice by maintenance personnel.

- N. Install strainers as indicated on the drawings. Provide a nipple and ball valve in the blow down connection of each strainer 2" and larger.

3.2 UNIONS AND FLANGES

- A. Unions and flanges shall be installed at pipe connections to fixtures and equipment and as required for erection purposed. A union shall be installed at each threaded shut-off valve on the side of the valve for which shutoff service is intended.

3.3 PIPE SLEEVES

- A. Pipe sleeves shall be placed in the initial stages of construction before concrete, masonry, and other general construction activity. Means shall be taken to assure that the sleeve will not move during or after construction. Beams, columns, and other structural members shall not be sleeved except upon approval of the Architect.
- B. Sleeves are not required in the following:
 - 1. In stud and gypsum board or plaster walls and partitions which are not fire rated.
 - 2. For uninsulated pipe passing thru masonry walls and partitions and stud and gypsum board or plaster walls and partitions. Sleeves are required however, for uninsulated condenser water piping for which expansion, contraction and other pipe movement can be expected.
 - 3. In core drilled openings in solid concrete not requiring water protection. Sleeves are required, however, at core drilling thru hollow pre-cast slabs and concrete block walls, to facilitate containment of required firestopping material.
 - 4. In large floor openings for multiple pipe and duct risers which are within a fire rated shaft, unless the opening is to be closed off with concrete or other material after pipe are set.
- C. Length of wall sleeves shall be such that the sleeve ends are substantially flush with both sides of the wall or partition. Floor sleeves shall be flush with the bottom and top of the floor slab except, in mechanical rooms and other areas which might have water on the floor, sleeves shall project a minimum of 1" above finished floor. Pipe sleeves shall be sized to allow insulation to pass thru the sleeve, for insulation requiring continuous vapor barrier (domestic cold water, chilled water refrigerant, etc.). Where vapor barrier continuity is not needed, the sleeve may be sized to pass the pipe only or the insulation as well. Refer to the following paragraph for qualification and exceptions relating to firestopping.
- D. Pipe sleeves which are part of firestopping assemblies shall conform to the requirements of the assembly with particular emphasis regarding size, annular space, length, passage or non-passage of insulation and the installation of the sleeves.

- E. Where firestopping is not required, the annular space between the sleeve, core drilling or opening and the pipe or pipe insulation shall be closed with caulking to retard the passage of smoke.
- F. Where uninsulated pipes requiring no pipe sleeves pass thru non-fire rated floor, wall or partition, the annular space shall be closed with material and methods compatible with the wall or partition material (Type M masonry grout, drywall joint compound, plaster, etc.).

3.4 PIPE SCHEDULES

- 1. See Schedule on Drawings

END OF SECTION 23 2113

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SECTION 23 2114 - HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes.
 - 1. Hydronic Specialties and Accessories
 - a. Air/Dirt Removal Fittings
 - b. Pressure Reducing Valves
 - c. Pressure Relief Valves
 - d. Make-up Water Assemblies
 - e. Air Vents
 - f. Strainers
 - g. Combination Valves (Triple-Duty)
 - h. Pump Suction Diffusers
 - i. Pot-Type Bypass Filter Feeders
 - 2. Expansion Tanks

- B. Related Sections:
 - 1. 23 0523 General Duty Valves
 - 2. 23 0529 Pipe Hangers and Supports
 - 3. 23 2113 Hydronic Piping.

1.2 PERFORMANCE REQUIREMENTS

- A. Piping systems shall conform to ANSI and State rules for pressure piping where applicable. Welders and fitters shall be fully certified for work performed.

- B. Safety valves and all pressure vessels shall bear the appropriate ASME label.

1.3 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Hydronic specialties.

- B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 HYDRONIC SPECIALTIES

- A. Air/Dirt Removal Fitting – Intended for mounting in main pipe shall be equal to Spirotherm #Spirovent VDT and tappings for air vent and drain. Furnish a large capacity float type air vent equal to Hoffman No. 792 with a ball shutoff valve for installation on the vent connection.
- B. Pressure Relief Valves
1. System Make-up Water – Shall be equal to Bell & Gossett Model B7 (adjustable setting to 25 psi) / Model 7 (adjustable setting 25 to 60 psi), setting as indicated on the drawings.
 2. Boilers – Shall be ASME rated for water relief, equal to Bell & Gossett No. 790 (3/4") / No. 1170 (1") / No. 3301 (1-1/2") / 4100 (2") with low inlet pressure check valve, setting as indicated on the drawings.
- C. Water Make-up Assemblies – Intended for use in the heating hot water system shall be an external electric float switch equal to McDonnell & Miller No. 158, with low water switch and alarm bell, and a remote make-up valve, ¼ turn ball type, with bronze body and 115V electric operator equal to Watts EA350. Wiring between the float switch, the alarm bell and the make-up water valve shall be by the HVAC contractor.
- D. Air Vents – Shall be manual type unless specifically noted to be automatic. Air vents shall be:
1. Large capacity automatic type for installation on boiler or air removal fitting, equal to Hoffman 792, 150 psig operating pressure rating. Provide a ball valve on the inlet pipe and pipe the outlet to the nearest drain.
 2. Large capacity automatic type, 150 psig operating pressure rating, equal to Hoffman 78. For use on air handling unit coils and on main piping. Provide ball valve at inlet of each vent. Pipe outlet to nearest drain point with 1/8" ID copper tube.
 3. Large capacity manual type – ½" ball valve for use on air handling unit coils and on main piping. Elbow down to facilitate catching water during venting.
 4. Small capacity manual-automatic with screwdriver stop, 50 psi, equal to Hoffman 500, for use on room heating and cooling units, VAV unit heating coils and duct heating coils.
 5. Small capacity manual type air vent – 1/4" ball valve, for use on room heating and cooling units, VAV unit heating coils and duct heating coils. Elbow down to facilitate catching of water during manual venting.
- E. Strainers – Shall be 125 lb. w.s.p. "Y" pattern cast iron construction with removable stainless steel strainer element and screwed or flanged ends. Strainer elements shall be 20 mesh for 2" and smaller, 1/16" for 2-1/2", 3" and 4" and 1/8" for larger sizes.
- F. Combination Triple Duty Valve – combination valves and devices such as Bell & Gossett Triple Duty Valve (check, balancing and shutoff) for installation on pump discharge are acceptable in lieu of individual components.

- G. Pump Suction Diffusers – Intended for pump inlet condition enhancement. Equal to that manufactured by Bell & Gossett.
- H. Pot-Type Bypass Filter Feeder – Intended to add small quantities of chemicals to the hot water systems where shown on the drawings and for side stream filtration. Five (5) gallon size equal to Neptune #FTF-5DB. Feeders shall be constructed for min. 150 psi and be complete with fill and valved bypass arrangement. Provide with 5 micron filter bags and dissolving cylinder.

2.2 EXPANSION TANKS

- A. Expansion tanks for pressurization and expansion control of the water systems shall be pressurized diaphragm or bladder type as indicated on the drawings, pre-charged to match the system make-up pressure.
- B. Construction – Each tank shall be welded steel constructed in accordance with ASME requirements for 125 psi. The tank shall be fitted with a system pipe connection drain tapping and an integral heavy duty replaceable butyl bladder, to separate water from the pressurized air. Bladder type tank shall have a bottom drain tapping with plug and a flanged top opening for removal and reinstallation of the bladder. Tank shall be prime coat or finish painted. The tank shall be vertical with floor mounting ring. Tank sized for full acceptance volume.
- C. Tank shall be equal to Bell & Gossett Series “B”, of vertical configuration and acceptance volume as indicated on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Drawings (plans, schematics and diagrams) indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, pipe expansion, pump sizing and other design considerations; therefore, it is imperative that piping be installed as indicated.
- B. Refer to Section 23 2113 Hydronic Piping for installation of piping and accessory devices and equipment.
- C. Air vents shall be installed at all high points of piping and system, on each heating and cooling coil, and at other locations subject to air binding. Air vents shall be installed in locations accessible for servicing. A shutoff valve or cock on the inlet and drain tubing extending to a drain is required for each large capacity automatic vent. The drain tube shall be extended to a drain location (floor drain, janitor sink, etc.) or, in mechanical rooms, turned down over a clear area of the floor to afford notice by maintenance personnel.
- D. Install strainers as indicated on the drawings. Provide a nipple and ball valve in the blow down connection of each strainer 2” and larger.
- E. Vertical expansion tanks shall be floor set on a 4” high concrete base. Check and adjust the pre-charged pressure so that it matches the system make-up pressure.

END OF SECTION 23 2114

SECTION 23 2117 – GLYCOL HEAT TRANSFER FLUID

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Ethylene Glycol
 - 2. Glycol Feed Equipment

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 FREEZE PROTECTION FLUID

- A. Ethylene glycol freeze protection fluid with special inhibitor formulation for HVAC application.
- B. Manufacturers:
 - 1. Dow Chemical “Dowtherm SR-1”.
 - 2. Interstate Chemical “Intercool NFE”
 - 3. Union Carbide “Ucartherm”

2.2 AUTOMATIC GLYCOL FEED EQUIPMENT

- A. Packaged automatic glycol feed unit consisting of at tank, pump piping devices, control panel, and sensors all mounted on a primed and painted steel frame.
 - 1. Tank: 50 gallon polyethylene with 1/3 hinged PE cover supported by the assembly.
 - 2. Control Panel: NEMA 4x panel with 8 foot power cord and plug, 2-position main power switch and light, 3-position (hand/off/auto) switch and light for pump, red low light and 15 amp fuse.

3. Pump: 1/3 HP gear pump providing 1.6 GPM at 100 psi. Pump suction PVC ball valve, flexible tubing and cast iron strainer. Pump discharge PVC ball valve, PVC spring check valve and 0.25" NPT back tap pressure gauge.
4. Pressure Switch: 0.25" NPT pressure switch
5. Pressure Relief Valve: 0-150 psig, PVC relief valve and gauge.

B. Manufacturers:

1. J.L. Wingert Co – Model GL50-E1
2. Neptune Chemical Pump Co.
3. Advantage Controls.

PART 3 - EXECUTION

3.1 REQUIREMENTS

- A. The chilled water piping system shall be provided with 30% by volume, ethylene glycol.
- B. Provide an extra 50 gallons of concentrated ethylene glycol. Place container(s) where so directed by the owner.

3.2 INSTALLATION

- A. Prior to introduction of the glycol solution, the piping system shall be thoroughly cleaned and prepared in accordance with Section 23 500 HVAC Water Treatment.
- B. Provide valved inlet connections, sampling valves, air vents, etc. Pump the solution into the piping, bleed air manually, circulate and test for correct concentration.
- C. When concentrated ethylene glycol is mixed on the job site, it shall be thoroughly mixed in a drum or drums to the specified solution prior to introduction in the piping system.
- D. Set glycol feed unit/tank and connect to the system where indicated on the drawings.

END OF SECTION 23 2117

SECTION 23 2123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Pipe mounted In-Line.
 - 2. Base mounted end suction
- B. Related Sections
 - 1. 23 0513 Electrical Requirements for HVAC Equipment

1.2 SUBMITTALS

- A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- C. Pumps shall be tested and rated in accordance with Hydraulics Institute standards.

PART 2 - PRODUCTS

2.1 MOTORS

- A. Motors shall be 1750 rpm unless specifically noted otherwise. Motors shall be sized to not overload or enter into the service factor area at any point on the operating curve of the pump. Submittals shall include pump curves. Drives and couplings shall be protected with guards conforming with OSHA standards.

- B. Motors 1 HP and larger shall be “premium efficiency” series motors.

2.2 PIPE MOUNTED IN-LINE

- A. Vertical motor axis pipe-mounted close coupled in-line centrifugal style, bronze fitted with cast iron casing, brass or bronze impeller, mechanical seals, flanged ends and close coupled motor.
 - 1. Manufacturers:
 - a. Bell & Gossett Series 90, or equal by
 - b. Armstrong
 - c. Patterson
 - d. Grundfos
 - e. Taco

2.3 BASE MOUNTED END SUCTION

- A. Base mounted end suction pumps shall be centrifugal type with flexible coupling, motor and channel steel or cast iron base with “back pull out” design. Each pump shall be bronze fitted with cast iron casing, bronze impeller, grease lubricated ball bearings, mechanical seals and flanged pipe connections (except pumps 2” and smaller may be threaded end).
 - 1. Manufacturers:
 - a. Bell & Gossett Series 1510, or equal by
 - b. Patterson
 - c. Armstrong
 - d. Grundfos
 - e. Taco

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- C. Install continuous-thread hanger rods and spring hangers of sufficient size to support pump weight.
- D. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.
- E. Furnish a spare pump seal for each type and size of pump.

3.2 ALIGNMENT

- A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.
- B. Comply with pump and coupling manufacturers' written instructions.
- C. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with non-shrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

END OF SECTION 23 2123

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SECTION 23 2500 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following HVAC water-treatment systems:
1. Bypass (Shot) chemical-feed equipment and controls.
 2. Biocide chemical-feed equipment and controls.
 3. Chemical treatment test equipment.
 4. Pipe cleaning procedures.

1.2 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Closed hydronic systems, including hot-water heating and chilled water shall have the following water qualities:
1. pH: Maintain a value within 9.0 to 10.5.
 2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
 3. Boron: Maintain a value within 100 to 200 ppm.
 4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
 5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 6. TDS: Maintain a maximum value of 10 ppm.
 7. Ammonia: Maintain a maximum value of 20 ppm.
 8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
 9. Microbiological Limits:
 - a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
 - b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
 - c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
 - d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
 - e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: Power and control wiring.
- C. Field quality-control test reports.
- D. Other Informational Submittals:
 - 1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
 - 2. Water Analysis: Illustrate water quality available at Project site.
 - 3. Passivation Confirmation Report: Verify passivation of galvanized steel surfaces, and confirm this observation in a letter to Architect.

1.4 QUALITY ASSURANCE

- A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUAL CHEMICAL-FEED EQUIPMENT

- A. Bypass (Shot) Filter Feeders: Refer to Section 23 2114 Hydronic Specialties.
- B. Water Meter – Provide on heating hot water system makeup water assembly.
 - 1. AWWA C700, oscillating-piston, magnetic-drive, mechanical totalization meter.
 - 2. Body: Bronze.
 - 3. Maximum Pressure Loss at Design Flow: 3 psig.
 - 4. Registration: Gallons.
 - 5. Controls: Flow-control switch with normally open contacts; rated for maximum 10 A, 250-V ac; and that will close at adjustable increments of total flow.

2.2 CHEMICALS

- A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.

B. System Cleaner:

1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

- A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
- B. Install water testing equipment on wall near water chemical application equipment.
- C. Install interconnecting control wiring for chemical treatment controls and sensors.
- D. Mount sensors and injectors in piping circuits.
- E. Bypass Filter Feeders: Install in closed hydronic systems, including hot-water heating and equipped with the following:
 1. Install bypass filter feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
 2. Install water meter in makeup water supply.
 3. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
 4. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
 5. Install a swing check on inlet after the isolation valve.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Division 23 Section "Common Work Results for HVAC."
- D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 23 Section "General-Duty Valves."

- E. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers required in makeup water connections to potable-water systems.
- F. Confirm applicable electrical requirements in Division 26 Sections for connecting electrical equipment.
- G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 PIPE CLEANING

- A. Pipe cleaning shall occur before the system is filled with water for leak testing or water balancing.
- B. The cleaning and passivating solution shall be formulated to remove light grease, cutting oils, loose mill scale, organics and extraneous construction debris. The cleaner shall include a polyphosphate, an ionic dispersant and a low foaming surfactant.
- C. Sufficient cleaner shall be used to treat all piping to remove oil and grease to permit a uniform passivating film.
- D. Place terminal equipment control valves in the open position during cleaning. Provide temporary piping connections at the ends of all dead end branches to provide a connection between the supply and return piping to circulate the cleaning solution. The temporary connection must be removed, not simply valved off, after pipe cleaning is complete.
- E. Systems shall be filled, started, vented and flushed with clean water prior to cleaning. Use water meter to record capacity in each system.
- F. Refill system and add required quantity of cleaning chemical solution into the circulating system. Solution shall be introduced before the circulation pumps so that pump operation will ensure rapid mixing and distribution of the solution throughout the system. A small amount of antifoam agent may be added to prevent excess foaming.
- G. Where the piping system is used for heating purposes, warm the water to between 80 and 90 deg.F. during the cleaning process.
- H. Circulate the solution throughout the system for 24-36 hours.
- I. Open and drain dirt legs and low points periodically during the cleaning process. Drain the system completely paying particular attention to dirt legs and low areas of the system where settling can occur.
- J. Refill system with clean potable or industrial water and clean all strainer screens. Circulate for 8-12 hours and completely drain system as before.

- K. Refill the system. The length of time between the completion of the cleaning procedure and the addition of the corrosion inhibitor shall not exceed 24 hours.
- L. Add the recommended inhibitor based on the measured system volume.
- M. Cleaning service technician shall provide a report certifying cleaning has occurred in accordance with the above procedure and the report shall be included in the Owner's manual.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
 - 2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
 - 3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
 - 4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
 - 5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
 - 7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
 - 8. Repair leaks and defects with new materials and retest piping until no leaks exist.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. At eight-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article.

F. Comply with ASTM D 3370 and with the following standards:

1. Silica: ASTM D 859.
2. Acidity and Alkalinity: ASTM D 1067.
3. Iron: ASTM D 1068.
4. Water Hardness: ASTM D 1126.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

END OF SECTION 23 2500

SECTION 23 3113 - DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Duct materials.
2. Duct liner.
3. Rectangular ductwork.
4. Round ductwork.
5. Duct connectors.
6. Sealants and gaskets.
7. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 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 "Duct Schedule" Article.
- 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 62.1-2004.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Fabrication, assembly, and installation techniques.
2. Factory- and shop-fabricated ducts and fittings.
3. Reinforcement and spacing.
4. Seam and joint construction.

5. Duct Connectors
 6. Duct Liner
 7. Duct Sealants and Gaskets
 8. Penetrations through fire-rated and other partitions.
 9. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 10. Hangers and supports, including methods for duct and building attachment, and vibration isolation.
- C. Coordination Drawings: Plans, drawn to scale (1/4" = 1'-0"), on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Duct installation indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 2. Suspended ceiling components.
 3. Structural members to which duct will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Penetrations of smoke barriers and fire-rated construction.
 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.
- D. Welding certificates.

1.4 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 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 DUCT MATERIALS

- A. Galvanized Steel Ductwork

1. Construction – Lock-forming, 24 gauge minimum, except as otherwise noted or specified.
 - a. Concealed Ductwork – Hot dipped, galvanized both sides, G90 per ASTM A653.
 - b. Exposed Ductwork in Finished Areas – Hot dipped, heat treated galvanized both sides, A40 per ASTM A653.
2. Finish
 - a. Concealed Ductwork – Type G1 – No additional finish required.
 - b. Exposed Ductwork in Finished Areas – Type G2 – Painted uniform gray matte appearance.

2.2 DUCT LINER

- A. Interior insulating duct liner for acoustical and thermal insulating purposes shall be shop applied to rectangular ductwork as shown on the drawings. Duct liner in rectangular ducts shall be 1" thick flexible fiberglass equal to:
 1. Johns Manville "Linacoustic RC" or
 2. Owens Corning SOFTR Aeroflex Plus Type 300
 3. Microbial growth inhibitor, minimum R value 4.2 with acrylic coating to prevent air erosion. Liner noise reduction coefficient (NRC) shall be .65 or better. Liner shall be applied with mastic on 100% of the surface and pin fasteners, per manufacturers instructions. Leading edges shall be protected with a sheet metal "Z" or channel and all joints shall be closed with heavy coating of neoprene. Duct sizes on drawings are inside clear dimensions. Sheet metal dimensions are 2" greater in each direction.

2.3 RECTANGULAR DUCTWORK

- A. Construction
 1. Single wall factory- or shop-formed continuous helical (spiral) lock seam.
- B. Fittings/Transitions – Shall conform to SMACNA Figure 2-7.
 1. Transition angles shall be limited to 30 degrees on converging transitions and 20 degrees on diverging transitions.
 2. Elbows shall have an inside radius equal to the duct width. 90 degree elbows shall be square with double wall turning vanes. Elbows less than 90 degrees shall be radiused. Non-radiused elbows less than 90 degrees, with or without turning vanes are not permitted.
 3. Branch take-offs, where not detailed otherwise, shall be with a static boot (45 degree clinch collar) per SMACNA Figure 2-6 or conical spin-in fitting. Straight tap take-offs are not permitted.
 4. Square throat, radius heel 90-degree elbows are not permitted.

2.4 ROUND DUCTWORK

- A. Medium pressure applications, upstream of VAV boxes (2" S.P. and higher).
 1. Construction
 - a. Single wall factory- or shop-formed continuous helical (spiral) lockseam.
 - 1) Manufacturers: McGill AirFlow "Uni-Seal" or "Uni-Rib" or equal by Lindab or SEMCO.

2. Joints/Seams
 - a. Slip connections or gasketed flanges.
 3. Fittings/Transitions – Shall be compatible with duct system.
 - a. 90-Degree Branch tees shall be streamlined, spin-in conical type with Y branches.
 - b. 45-Degree lateral tee wherever possible.
 - c. Die-stamped elbows, $r/D = 1.5$ (minimum).
 - d. Radiused, angled (15° max.) or mitered (15° max.) offsets.
 - e. Concentric transitions, $\theta = 45^\circ$ max.
 - f. Eccentric transitions, $\theta = 30^\circ$ max.
- B. Low pressure applications, downstream of VAV boxes (1" S.P. or less).
1. Construction
 - a. Single wall factory- or shop-formed continuous helical (spiral) lockseam.
 - 1) Manufacturer: McGill AirFlow "Uni-Seal" or "Uni-Rib" or equal by Lindab or SEMCO.
 2. Joints/Seams
 - a. Slip connections or gasketed flanges.
 - b. Longitudinal seams may be utilized for 1" and less (positive and negative) static pressure construction class at final air devices.
 3. Fittings/Transitions – Shall be compatible with duct system.
 - a. Factory- or shop-formed and welded.
 - b. Elbows shall be long radius type.
 - c. Standard tees allowed.
 - d. Segmented elbows allowed.
 - e. Elbows for longitudinal seam round ductwork shall be factory- or shop-formed segmented standing seam or pleated. Other fittings shall be comparable to the elbows.
 - f. Manufacturers: McGill AirFlow "Uni-Seal" or "Uni-Gasket" with beaded sleeve transverse joint connectors.

2.5 DUCT CONNECTORS

- A. Rectangular Duct Connectors
 1. Shall be equal to Ductmate Industries "25 and "35" may be used on rectangular ductwork except where welding or brazing is specifically required. Adhere strictly to manufacturers instructions.
- B. Round duct branch connection to rectangular sheet metal duct
 1. Shall be equal to Flexmaster Series FL, straight side with or without manual damper, as described on the drawings. Connectors installed on interior lined rectangular duct shall have an integral insulation guard sleeve.
- C. Rectangular tap-to-round branch connection with static boot configuration
 1. Shall be equal to Flexmaster USA Type STO. Buckley "Air-Tite" Bellmouth BM and BM-D fittings with neoprene gasket and adhesive facing may be used for duct taps to rectangular sheet metal duct which is not internally lined.

2.6 SEALANT AND GASKETS

- A. Duct sealant materials shall be:
 - 1. Water based synthetic latex emulsion duct sealant equal to Ducmate PROSeal.
 - a. No V.O.C's
 - b. UL 181B-M Listed, UL 723 classified
 - c. For applications up to 15" w.g.
 - d. Gray Color
- B. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.7 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

I.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General
 - 1. 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.

2. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

B. Ductwork Coordination

1. Coordinate duct layout carefully with other trades to avoid conflict with structural elements, lighting and plumbing- heating piping. Flattening of ductwork and offsets to fit ductwork in available space is generally shown. In the absence of such, the Contractor shall arrange the ductwork to maintain concealment and allow ceilings and lights to be installed as intended. Do not hang ductwork until possible interferences with electrical and mechanical trades have been resolved. Having ductwork fabricated and delivered in advance shall not be justification for interference with other trades.
2. Provide a complete set of 1/4" = 1'-0" sheet metal fabrication drawings. The drawings shall be used for overall coordination with the other trades. Meet with the other trades prior to developing and finalizing these drawings.

C. Joints & Seals

1. Transverse joints and longitudinal seams shall be assembled with sealant to conform to SMACNA Class B seal. Selection of sealant materials shall be compatible with the application. Sealants shall be applied in accordance with manufacturer's recommendations.
2. Exterior ductwork shall be sealed with mineral impregnated fiber tape. Ductwork shall be supported as noted or detailed on the drawings.

D. Hangers, Straps & Supports – Attachment of hangers, straps, and supports to the structure shall be as follows:

1. Concrete Construction
 - a. Pre-set concrete inserts in concrete construction of 4" minimum depth.
 - b. After-set concrete inserts, in 4" minimum depth concrete, set in drilled holes. Powder actuated driven fasteners are not permitted.
2. Steel Construction – Utilize beam clamps in steel construction. Provide anchoring where clamps are attached to sloping surfaces of beam flanges and where otherwise required to insure permanent attachment.
3. Wood Construction – Side beam bracket in wood construction, secured to the wood joist with lag screws set in drilled pilot holes.
4. Unistrut type channel support systems may be utilized. Channel shall be attached to the structure with inserts or clamps.
5. Attachment to steel deck is prohibited. Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not

practical. This does not apply to steel deck with concrete slab poured on the deck. Refer to A. and B. above.

6. Attachment to manufactured trusses and other engineered structural members and supports shall be done in strict accordance with the structural manufacturer's recommendations. Refer to the architectural and structural drawings for type of engineered structural systems being used. Connections to these structural members shall be made with connection devices and methods approved by the structural manufacturer. Provide additional supports with supplemental steel shapes when spacing between structural members exceeds specified distances.

E. Duct Routing and Penetrations

1. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures. Ductwork shall not be run above electrical switchgear or panelboards, nor above the access space in the immediate vicinity of the equipment in accordance with NEC.
2. 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.
3. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
4. Coordinate openings required for the passage of ductwork thru walls, partitions, floors and roofs with the General Contractor.
5. Sheet metal sleeves in conjunction with fire dampers shall be placed in walls and floors to pass ductwork. Floor sleeves shall project 4" above the finished floor in equipment rooms and areas of similar usage, and shall form a waterproof seal. Exceptions shall be at locations where the opening is protected from drainage falling thru by means of concrete curbs or shaft walls. This Contractor shall be responsible for providing 4" high x 4" wide concrete curbs with beveled edges to protect floor openings related to his work in equipment rooms or providing an equal effective waterproofing metal curb, if not specifically included in the General Contract.

F. Duct Protection & Cleaning

1. Protect duct interiors from moisture, construction debris and dust, and other foreign materials by covering each open end of the duct with visqueen secured with duct tape before the end of each day's work. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."- Duct Cleanliness Level – Basic, Intermediate, Advanced.

- G. Interior insulating duct liner shall be installed in strict accordance with manufacturer's printed instructions and SMACNA standards. Liner in rectangular duct shall be shop applied with adhesive over 90% of the surfaces and with weld pins. Edges not factory sealed, cut edges and all joints shall be coated and closed with an adhesive-sealant, both in shop fabrication and field

assembly. Leading edges shall be protected with metal "Z" or channel nosing where air velocity exceeds 3,000 fpm. Duct liner shall be protected from getting wet or dirty while being transported to the building site, stored on site and after installation.

- H. Where interior duct surfaces are visible thru grilles, registers and diffusers, the inside of the duct shall be coated with flat black paint before the device is installed, to eliminate obtrusive appearances.

3.2 DUCT SCHEDULE

- 1. Refer to schedule on Drawings.

END OF SECTION 23 3113

SECTION 23 3119 - PLENUM CASINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shop and field fabricated plenum casings for outside, vent and exhaust air systems, including access doors.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
 - 1. Casings shall be fabricated to withstand 3" w.c. positive or negative static pressure without structural failure. Wall and roof deflection at the indicated static pressure shall not exceed 1/8 inch per foot of width. Provide steel supports to maintain
 - 2. Elevated casings 3' high and larger that are provided with access doors shall have the bottom floor designed to support the weight of a maintenance worker.

1.3 SUBMITTALS

- A. Shop Drawings: Provide construction details including reinforcement, sealing, liner, devices, etc.

1.4 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 GENERAL CASING FABRICATION REQUIREMENTS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 6, "Equipment and Casings," for acceptable materials, material thicknesses, and casing construction methods unless otherwise indicated.
- B. Plenum casings shall be single wall, external standing seam, galvanized metal construction designed for 3" positive and 3" negative construction except the floor. The floor of the plenum casing shall be stainless steel construction with continuously welded seams and joints. The

stainless-steel floor shall be a pan construction, with continuously welded edges turned up a minimum of 12" on all sides that extend up and connect to the galvanized wall. Alternatively, the entire plenum casing can be galvanized construction with a stainless-steel pan as described extending across the entire floor of the plenum. Provide trapped drain with deep trap – refer to condensate trap detail.

- C. Metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- D. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M, G90 finish.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. Black steel may be used on the exterior of the plenum only; all interior metal shall be stainless steel or galvanized sheet metal as described. All fasteners, joints, threads, etc. where the galvanizing has been removed shall be cold galvanized in the field.
- F. Sealing Requirement: SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class A. Seal all seams, joints, connections and abutments.
- G. Penetrations: Seal all penetrations air and water tight. Cover with escutcheons and gaskets, or fill with suitable compound.
- H. Plenums shall be externally insulated in the field with fiberglass board insulation.

2.2 SEALANT MATERIALS

- 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. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 8. Service: Indoor.
 - 9. Substrate: Compatible with galvanized sheet steel and stainless steel.
- C. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single component, acid curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.

5. Use: O.
6. Use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Field-cut openings for pipe and conduit penetrations; insulate and seal according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Support plenum casings from the floor or from structural wall and roof elements. Support components rigidly with ties, braces, brackets, and anchors of types that will maintain housing shape and prevent buckling.
- C. Align casings accurately at connections, with smooth interior surfaces.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Perform field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual."

3.3 CLEANING

- A. Comply with Division 23 Section "Metal Ducts."

END OF SECTION 23 3119

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SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual balancing dampers.
2. Backdraft dampers.
3. Fire dampers.
4. Smoke dampers.
5. Combination fire-smoke dampers.
6. Pressure Differential gauges.
7. Turning vanes.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Flexible ducts.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details, and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
 - d. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

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.

PART 2 - PRODUCTS

2.1 MANUAL BALANCING DAMPERS

- A. Balancing dampers shall be single cross-blade up to 12 blade widths and in larger sizes, multiple blade type 6" maximum width with opposed blade arrangement. Dampers shall be controlled by a locking quadrant positioner with handle equal to vent fabrics "Ventlock" #641 and for externally insulated ducts #644

2.2 BACKDRAFT DAMPERS

- A. Backdraft dampers shall be adjustable counterbalanced type with extruded aluminum frame and blades and extruded vinyl edge seals. Dampers shall be equal to Ruskin CBD6.

2.3 FIRE DAMPERS

- A. Dampers shall be constructed and tested to conform with UL 555 and shall be UL listed.
- B. Dampers shall be dynamic rated, folded blade curtain type with blades folded in the head of the damper housing and shall be equipped with a 165 degree (unless otherwise noted) fusible link. Dampers installed to a horizontal air stream shall be gravity drop type. Dampers in a vertical air stream shall be spring loaded type.
- C. The following is a description of the fire damper types as indicated on the plans:
 - 1. TYPE "A"
 - a. Low velocity (below 2000 fpm) with blades stored in the air stream.
 - 2. TYPE "B"
 - a. Low velocity with blades stored out of the air stream.
 - 3. TYPE "C"
 - a. High velocity with blades stored out of the air stream and rectangular, round, or oval duct collar each side.
 - 4. Fire dampers located at double wall locations shall be provided with a closed position proving micro-switch. Switch shall change state if the fusible link releases and closes the fire damper. The switch shall be equal to Honeywell BX-2RW863-A2.

2.4 PRESSURE DIFFERENTIAL GAUGES

- A. Pressure differential gauges for air filter application shall be Dwyer "Magnehelic" Series 2000 dial type gauges. Range shall be appropriate for the application. Each gauge shall be furnished with vent valves, aluminum or plastic tubing, static pressure tips and mounting bracket or flange.

2.5 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.
 - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- E. Vane Construction: Single wall for ducts up to 36 inches wide and double wall for 36" wide and larger dimensions.

2.6 DUCT-MOUNTED ACCESS DOORS

- A. Duct Access Doors – Doors shall be factory fabricated with following characteristics:
 - 1. Construction Material – Constructed of the same material as the ductwork system served (except galvanized sheet metal for fiberglass duct).
 - 2. Door Thickness – Doors located in:
 - a. Insulated ductwork (internal and/or external) shall have double-wall insulated doors, thickness as required per the insulation schedule.
 - b. Uninsulated ductwork shall have single-wall construction.
 - 3. Hinge – Continuous Piano Hinge. 1.5" wide steel construction, zinc plate.
 - a. Ventfabrics #Ventlok 157 or equal.
 - 4. Latches – Provide the following type of latch for each application:
 - a. Low pressure ductwork (1" w.c. or less) – Cam lock type latches.
 - b. High Pressure ductwork (greater than 1" w.c.) – Heavy duty handle type latches.
 - 5. Frame & Seal – Frame and neoprene gasket between door and frame.
 - 6. Size – Access doors shall be 18" x 16" minimum except smaller where duct size will not permit such size.
 - 7. Pressure Application – Access doors and panels shall be designed to provide tight seal commensurate with the duct system operating pressure. Apply duct sealer or rubber gasket between frame and duct and on ducts of 3" S.P. and higher construction class, mechanical fastening of the frame and rubber gasket shall be provided.
 - 8. Removable Sash Access Door – Where sufficient clearance is not available to allow the door to swing open 90 degrees or for round ductwork, a removable access panel with

neoprene gasket, frame and cam lock latches on all four sides shall be provided in lieu of the hinged door.

- B. Large Plenum Access Doors – doors shall be factory fabricated and as described for duct access doors except that doors shall be 18” x 48” (unless otherwise noted) with overlapping frame,
 - 1. Construction Material – Constructed of the same material as the ductwork system served (except galvanized sheet metal for fiberglass duct).
 - 2. Door Thickness – Doors located in:
 - a. Insulated ductwork (internal and/or external) shall have double-wall insulated doors, thickness as required per the insulation schedule.
 - b. Uninsulated ductwork shall have single-wall construction.
 - 3. Hinge – Continuous piano hinge. 2” wide steel construction, zinc plated. Ventfabrics #Ventlok 167 or equal.
 - 4. Latches – Heavy duty type. Lever both outside and inside. Ventfabrics #Ventlok No. 310 or equal.
 - 5. Latch Quantity – Two latches shall be provided, except on doors 50” and higher three shall be provided.
 - 6. Frame & Seal - Shall be mechanically fastened to the plenum wall.
 - 7. Pressure Application – Access doors and panels shall be designed to provide tight seal commensurate with the duct system operating pressure. Apply duct sealer or rubber gasket between frame and duct and on ducts of 3” S.P. and higher construction class, mechanical fastening of the frame and rubber gasket shall be provided.

2.7 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 30 oz./sq. yd.
 - 2. Net Fabric Width: 4” wide.
 - 3. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 4. Service Temperature: Minus 40 to plus 200°F.
- E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd.
 - 2. Net Fabric Width: 4” wide.

3. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
4. Service Temperature: Minus 50 to plus 250°F.

2.8 FLEXIBLE DUCTS

- A. Flexible insulated duct shall be constructed of galvanized steel spiral wire mechanically locked to an airtight aluminum or polyester inner core, 1" thick 3/4 lb. density fibrous glass insulation and a polyethylene or reinforced metalized vapor barrier outer jacket equal to Flexmaster Type 5 or 5M. Duct shall be rated at a minimum of 6" positive and 4" negative static pressure and shall be listed as Class 1 Air Duct or Air Duct Connector with 25-50 flame-smoke ratings per UL 181 and comply with NFPA 90A.
- B. Non-insulated flexible duct equal to Flexmaster NI-85 may be used on duct systems not specified to be insulated, with similar restriction stated above.
- C. Flexible duct shall be used at final connections to air control terminal units and ceiling air diffusers except as limited in Part 3.

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL

1. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
2. Materials - Install duct accessories of materials suited to duct materials use:
 - a. Galvanized-steel accessories in galvanized-steel and fibrous-glass ducts,
 - b. Stainless-steel accessories in stainless-steel ducts,
 - c. Aluminum accessories in aluminum ducts.

B. FIRE AND SMOKE DAMPERS

1. Fire and smoke dampers shall be installed in conformance with the manufacturer's instructions and SMACNA recommendations.
2. Dampers shall be installed in sheet metal wall or floor sleeves along with retaining angles and duct access doors or panels. Sleeve and duct connections shall be breakaway type or rigid type with corresponding gauge requirements in accordance with SMACNA recommendations.

C. VOLUME DAMPERS

1. Locations:
 - a. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts.

- b. Install volume damper upstream/downstream of each supply, return or exhaust air device, register or grille.
- c. Volume dampers shall be located in accessible locations for testing, balancing and adjusting purposes. Coordinate with reflected ceiling plans.
2. 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.
3. Install steel volume dampers in steel ducts.
4. Install aluminum volume dampers in aluminum ducts.
5. Set dampers to fully open position before testing, adjusting, and balancing.

D. PRESSURE DIFFERENTIAL GAUGES

1. Install air filter pressure differential gauges in a readable location on or near the air handling unit, filter housing or as otherwise indicated on the drawings.

E. ACCESS DOORS

1. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - a. On both sides of duct coils.
 - b. Upstream / and downstream from duct filters.
 - c. At outdoor-air intakes and mixed-air plenums.
 - d. At drain pans and seals.
 - e. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - f. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - g. Control devices requiring inspection.
 - h. Elsewhere as indicated.
2. Label access doors according to Division 23 Section "Identification for HVAC System" to indicate the purpose of access door.

F. FLEXIBLE CONNECTORS

1. Location: Install flexible connectors to connect ducts to equipment.
2. For fans developing static pressures of 5-inch w.g. and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

G. FLEXIBLE DUCTS

1. Connect flexible ducts to metal ducts with Panduit straps or stainless-steel clamps. End of the insulation and jacket shall be sealed to the metal duct with double wrapped duct tape. Maximum length of flexible duct shall be:

- a. Terminal units to supply ducts – 3 ft.
 - b. Air devices to ducts – 7 ft.
2. Flexible duct installation locations:
- a. Shall be installed:
 - 1) At final air devices above accessible ceilings.
 - b. Shall *not* be installed:
 - 1) Where ductwork is exposed.
 - 2) Above inaccessible ceilings – coordinate with reflected ceiling plan.
 - 3) Thru any wall, ceiling, floor or fire rated assembly.
 - 4) In the immediate vicinity of, and connecting to, air devices in fire rated ceilings where the assembly details require steel ductwork.

END OF SECTION 23 3300

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SECTION 23 3400 - FANS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Inline Square Centrifugal Fan
 - 2. Downblast Power Roof Ventilator
- B. Related Sections
 - 1. 23 0513 Electrical Requirements for HVAC Equipment
 - 2. 23 0548 Vibration Control

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Fans shall be constructed, rated and labeled in accordance with AMCA Standard 210-67. Fans shall be statically and dynamically balanced throughout the operating range.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Fans shall be provided as specified below and shown on the drawings, complete with motors, drives and associated devices.

- B. All fans of any one listed type shall be of the same manufacturer.
- C. Motor HP shall be sufficient to handle the full load of the fan, including drive losses, at the selected condition without exceeding the motor rating. In no case shall the motor size be less than shown without prior approval from the Engineer. All motors 1 HP and larger shall be “premium efficiency” series. Motors which are fed from variable frequency drive controllers for variable speed operation shall be designed and constructed for VFD drive duty and shall be compatible with the controller specified in Section 23 0531 Equipment Drives. Refer to Section 23 0513 Electrical Requirements for HVAC Equipment.
- D. Belt drive units shall have adjustable motor base, “V” belts and pulleys.
- E. Motorized backdraft dampers, where specified, shall be furnished with a motor with voltage compatible with the fan motor voltage and electric service to the fan. If not compatible, a transformer and relay shall be furnished with the fan and damper to afford the appropriate voltage.

2.2 MOTORS

- A. Refer to Section 23 0513 - Electrical Requirements for HVAC Equipment

2.3 INLINE SQUARE CENTRIFUGAL FAN

- A. Construction – Backward inclined fan wheel, motor, adjustable “V” belt drive or direct drive, as indicated, belt guard, motor disconnecting means and inlet cone. Housing shall be constructed of square galvanized sheet metal with 1” acoustical lining.
- B. Mounting – Mounting brackets with neoprene vibration isolators for suspension mounting.
- C. Direct drive units shall have motor out of the air stream and be furnished with a solid state speed controller with off position, and cover plate. The speed controller shall be turned over to the Electrical Contractor for installation.
- D. Finish– The exterior of the fan shall be galvanized.
- E. Refer to the drawings for capacities, arrangement, class and other features and accessories. Fans shall be manufactured by:
 - 1. Acme
 - 2. Carnes
 - 3. Cook
 - 4. Greenheck
 - 5. Twin City Fan

2.4 DOWNBLAST POWER ROOF VENTILATOR

- A. Construction – Power roof ventilator shall consist of a spun aluminum weather hood, counterflashing base, vertical shaft open centrifugal wheel, adjustable “V” belt drive (except

fans with 13” dia. or smaller wheel may be direct drive) resiliently mounted motor, motor disconnecting means in the motor compartment, motorized backdraft damper and bird screen.

- B. Finish – The exterior of the fan shall be galvanized.
- C. Mounting – A 14” high insulated metal roof curb with straight edges and wood nailer on top shall be provided with each fan. Provide wood cant strips around the curb only if recommended for the roofing system.
- D. Refer to the drawings for capacities, arrangement, class and other features and accessories. Fans shall be manufactured by:
 - 1. Greenheck
 - 2. Cook
 - 3. Carnes
 - 4. PennBarry
 - 5. Twin City Fan

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fans and roof curbs level and plumb, in accordance with manufacturer’s written instructions.
- B. Support units as described below using the vibration control devices specified in Section 23 0548 Vibration Control.
- C. Arrange installation of fans to provide access space around fans for service and maintenance.
- D. Adjust damper linkages for proper damper operation. Motorized backdraft dampers are to be wired by the Temperature Controls Contractor to open when the fan operates.
- E. Perform the following operations and checks before start-up.
 - 1. Remove shipping blocking and bracing.
 - 2. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork and electrical are complete. Verify proper thermal overload protection is installed in motors starters and disconnects.
 - 3. Verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Align belts and reinstall belt guards.
 - 4. Lubricate bearings, pulleys, belts and other moving parts with factory-recommended lubricants.
 - 5. Verify manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in the full open position.

END OF SECTION 23 3400

SECTION 23 3600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Single-duct air terminal units

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- D. Terminal units shall be certified to comply with ARI Standard 880.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unit sizes (inlet duct dimension) shall conform to those listed on the drawings except where larger size is required (or smaller size is acceptable) to meet noise or operational requirements. Resultant noise level from the control unit, ductwork and diffusers, as a system, shall not exceed a room NC level of 25 from both airborne and radiated noise, based on a 10 db room absorption coefficient, with 1.5" w.g. s.p. differential across the unit at maximum cfm setting. Sound performance shall be ARI certified.
- B. Pressure drop thru the terminal unit and hot water coil shall not exceed the maximum drop listed on the drawings. The coil face area shall be upsized if necessary to meet this requirement. The terminal unit casing shall be correspondingly upsized or the larger coil furnished separately.

For a separately furnished coil and intervening duct transition, with internal insulation same as that in the terminal unit casing, shall be provided.

2.2 COMPONENTS AND ACCESSORIES

- A. Unit casing shall be 22 gauge minimum galvanized or galvanealed sheet metal with beaded round inlet duct connection. Casing shall be lined internally with ½” thick dual density (foil faced rigid fiberglass board, 1” thick, 4 p.c.f. Lining shall meet UL 181 erosion standards and NFPA 90A fire and smoke requirements. Edges, joints and other exposures shall be additionally coated or protected with metal edging.
- B. Fan blower shall be constructed of steel with forward curved blades, dynamically balanced wheels and direct drive motor. Unit shall include a backdraft damper at the fan section outlet to prevent cold primary air from flowing back through the fan into the ceiling plenum. Motor shall be an ECM DC brushless motor complete with and operated by a single-phase integrated controller/inverter that operates the wound stator and sensor motor position to electronically commutate the stator. All motors shall be designed for synchronous rotation. Motor shall maintain a minimum of 70% efficiency over its entire operating range. Motor shall be direct coupled to the blower. Provide isolation between the motor and the blower assembly. Unit shall include a manual fan speed control for field adjustment of fan air flow set point.
- C. Hot water reheat coil shall consist of copper tubes, aluminum fins and galvanized steel casing. Coil shall have ARI certified ratings and shall be hydrostatically tested at 200 psi. The coil section shall contain an access door on the upstream side of the coil, located on the bottom of the casing. Provide a manual air vent on the coil. Hot water control valve shall be furnished by the Temperature Controls Contractor.
- D. Air flow control damper or valve shall have linear control characteristics and shall be 16-gauge galvanized steel or extruded aluminum with gasketing and self-lubricating bearings.
- E. Velocity sensor shall be multi-point averaging type. The velocity sensor shall be mounted in the inlet air stream and shall amplify the air flow signal to provide accurate control at low, as well as high, inlet static pressure conditions. Required minimum static pressure of the volume regulator shall not exceed 0.25” w.g. for proper operation.
- F. Air flow taps shall be provided to enable direct reading of total static pressures. A conversion chart shall be attached to each unit to convert pressure readings to air flow quantities.
- G. Casing leakage and damper leakage shall each not exceed 2% of maximum air flow cfm at 3.0” s.p. differential across the unit.

2.3 MANUFACTURERS

- A. Units shall be manufactured by:
 - 1. Price
 - 2. Titus
 - 3. Trane
 - 4. Tuttle & Bailey

5. Enviro Tech

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Units installed in a return air plenum shall have a sheet metal housing to enclose non-plenum-rated control devices and wiring which are mounted on the exterior of the casing.
- B. Support the units from the building structure with solid steel hanger rods or sheet metal strap hangers. Units shall not be supported from the ceiling suspension system.
- C. Coordinate unit locations with ceiling components, light fixtures and other elements to insure adequate clearance for access and servicing. Provide ceiling access panels where the ceiling system does not afford ready access. Coordinate right/left hand connections prior to placing order. Units ordered with coil connections and or control boxes on inaccessible sides shall be re-ordered, the mounting of units "up-side-down" is not acceptable.
- D. Connect supply and return piping to each hot water coil with valves and unions. Provide a manual air vent at the coil. Automatic control valve will be furnished by the Temperature Control Contractor, installed by the HVAC Contractor.
- E. Control devices furnished by the Temperature Controls Contractor are to be sent to the unit manufacturer for factory mounting on the unit. Refer to the Temperature Control sections for controls and coordinate to provide a complete and operational system.
- F. Digital controller, damper operator and linkage, hot water control valve and room temperature sensor are to be furnished by the Temperature Control Contractor. Controller, damper operator, and linkage are to be sent to the terminal unit manufacturer for factory mounting.

END OF SECTION 23 3600

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SECTION 23 3713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grilles
2. Registers
3. Diffusers
4. Louvers
5. Special Air Diffusion Devices

B. Related Sections:

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 GRILLES, REGISTERS AND DIFFUSERS

- A. Air outlet and inlet devices shall be equal to those specified by catalog number and description in the schedule on the drawings. Damper operators shall be concealed screw type. An auxiliary mounting frame shall be furnished with each grille and register except those mounted on exposed ducts or in lay-in application.
- B. Linear "T" bar air supply diffusers shall be slotted diffusers with fixed air pattern control complete with a galvanized sheet metal supply plenum having a round or oval duct connection and 1/2" neoprene coated fiberglass insulation on the interior. The unit shall be designed to mount on or alongside the ceiling "T" bar and shall include flanges on both sides of the diffuser to support the ceiling tiles. Additional "T" bars matching those of the ceiling system shall be

provided by the HVAC Contractor if the diffuser does not have these flanges. Units shall have a center notch where required to accommodate intervening “T” bars.

C. Manufacturers:

1. Price
2. Titus
3. Tuttle & Bailey
4. Kreuger

2.2 LOUVERS

A. Louvers shall be exterior weatherproof drainable type equal to those scheduled and shown on the drawings. Louvers shall be assembled entirely by welding. Louvers shall withstand uniform wind loading pressure of 20 psf. Performance data indicating pressure loss and water penetration, derived from AMCA 500 testing, shall be included with submittals.

1. Aluminum louvers shall be 12 ga. Extruded aluminum with R1 caustic etch and finished with Kynar 500 (or equivalent) fluoropolymer finish. Color is to be selected by the Architect from the manufacturer’s standard colors.
2. Bird screen shall be ½” mesh aluminum wire on the interior face of the louver attached at 12” centers on the perimeter.

B. Manufacturers:

1. Ruskin
2. Pottorff
3. Greenheck
4. Airolite

2.3 SPECIAL AIR DIFFUSION DEVICES

A. Self contained variable volume ceiling diffusers shall be 24” x 24” nominal “T” bar ceiling lay-in type. Diffusers shall have four integral volume control dampers to regulate air volume on varying demand for both cooling and heating. Two integral thermal elements with room air aspiration and adjustable setpoint, one for cooling and one for heating, shall be arranged thru linkage to power the volume dampers. Changeover thermal element shall be incorporated in the diffuser to index cooling and heating in accordance with supply air temperature. Diffusers shall be Acutherm “Therma-Fuser” TF-HC Series.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall be responsible for comparability of ceiling mounted devices with the ceilings and suspension systems (lay-in, concealed spline, plaster , drywall, etc.). Verify with architectural drawings.
- B. Carefully align square and rectangular devices with the vertical and horizontal building lines. Diffusers shall be attached rigidly to the ductwork. Where connected by flexible ducts, special supports shall be provided as required, either from the ceiling suspension system or by independent suspension wires or rods from the building structure.
- C. Inside of ducts behind grilles, registers, and diffusers shall be painted flat black, as needed, to eliminate the sight of shiny surfaces.
- D. Exterior louvers shall be installed by the General / HVAC Contractor. Install louver assemblies in strict accordance with manufacturer's recommendations. Louvers to be installed plumb, square, level and true. Blank off all unused portions of the louver with 14 ga. Aluminum and insulate blank off with 1" rigid foil faced insulation. Seal blank off areas air tight.

END OF SECTION 23 3713

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SECTION 23 3723 - GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of roof-mounting intake and relief ventilators:
 - 1. Roof hoods.
- B. See Division 08 Section "Louvers and Vents" for ventilator assemblies provided as part of the general construction.
- C. See Division 23 Section 23 400 for roof-mounting exhaust fans.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: Include plans, elevations, sections, details, and ventilator attachments to curbs and curb attachments to roof structure.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized.
- D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

2.2 FINISHES

- A. Exterior of the ventilator shall be:
 - 1. Mill finish aluminum.

2.3 ROOF HOODS

- A. Manufacturers:
 - 1. Acme Engineering & Mfg. Corp.
 - 2. Aerovent; a Twin City Fan company.
 - 3. Carnes.
 - 4. Greenheck.
 - 5. JencoFan.
 - 6. Loren Cook Company.
 - 7. Penn Ventilation.
- B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 5-6 and 5-7.
- C. Materials: Aluminum construction with spun aluminum or reinforced rectangular formed weatherhead.
- D. Base: Counterflashing for curb mounting
- E. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; rigid fiberglass insulation adhered to inside walls; and wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Wood cant strips around the curb only if recommended for the roof system. Match roof slope so that the top of the curb is level.
 - 2. Overall Height: 12 inches.
- F. Bird Screening: Aluminum, 1/2-inch square mesh.
- G. Backdraft Dampers: Set within roof curb, furnished with the ventilator.
 - 1. Counterbalanced gravity type.
 - 2. Motor operated furnished by the Temperature Control Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install relief ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Secure relief ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible.
- C. Install relief ventilators with clearances for service and maintenance.
- D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

- E. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- F. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- G. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.
- H. Adjust damper linkages for proper damper operation.
- I. Vent air units shall have the underside of the hood insulated to prevent condensation of the vent air on the underside of the hood.

END OF SECTION 23 3723

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SECTION 23 5100 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Listed double-wall vents and chimneys.

1.2 SUBMITTALS

- A. Product Data: For the following:
 - 1. Building-heating-appliance chimneys.
- B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, diagrams, and attachments to other work. Provide submittals for all fittings, terminations and vents.

PART 2 - PRODUCTS

2.1 LISTED SPECIAL GAS VENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Heat-Fab, Inc.
 - 2. Metal-Fab, Inc.
 - 3. Metalbestos.
 - 4. Van-Packer Model CS Type BH
- B. Description: Double-wall metal vents tested according to UL 1738 (condensing) and rated for 1000 deg F continuously, or 1700 deg F for 10 minutes; with positive flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1-inch air space.
- D. Inner Shell: AL 29-4C or 29-4 (S44735) superferritic stainless steel.
- E. Outer Jacket: 430 Stainless steel.
- F. Pressure: Vent shall be listed for an internal static pressure of 15" w.g. and tested to 37" w.g.

- G. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - 1. Tees and elbows: Shall provide a pressure drop less than 15 feet equivalent horizontal vent.
 - 2. Joints: Inner wall joints shall be designed with a male and female overlapping metal-metal connection to maintain condensate on the AL29-4C stainless steel.
 - 3. Gaskets/Sealant: A factory installed 550°F compatible silicone rubber gasket shall be used to seal joints.
 - 4. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
- H. Compliance: System is to be sized in accordance with the appliance manufacturer's specifications, NFPA 54-National Fuel Gas Code (ANSI Z223.1), ASHRAE recommendations, and other applicable codes.

PART 3 - EXECUTION

3.1 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- C. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- D. Lap joints in direction of flow.
- E. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
- F. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- G. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 23 5100

SECTION 23 5216 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for generating heating hot water.

1.2 SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and wiring diagrams.
- C. Efficiency Curves: At a minimum, submit efficiency curves for 100%, 80%, 60%, 40%, 20% and 7% input firing rates at incoming water temperatures ranging from 80 deg. F to 170 deg. F.
- D. Pressure Drop Curve. Submit pressure drop curve for flows ranging from 0 GPM to maximum boiler flow.
 - 1. Should submitted material be different from that of the basis of design, boiler manufacturer shall incur all costs associated with reselection of necessary pumps.
- E. Source quality-control test reports.
- F. Field quality-control test reports.
- G. Operation and maintenance data.
- H. Warranty: Standard warranty specified in this Section.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. I=B=R Performance Compliance: Condensing boilers shall be rated in accordance with applicable federal testing methods and verified by AHRI as capable of achieving the energy efficiency and performance ratings as tested within prescribed tolerances.
- C. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers".

- D. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
- E. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
- F. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
- G. NOx Emission Standards: When installed and operated in accordance with manufacturer's instructions, condensing boilers shall comply with the NOx emission standards outlined in South Coast Air Quality Management District (SCAQMD), Rule 1146.1; and the Texas Commission on Environmental Quality (TCEQD), Title 30, Chapter 117, Rule 117.465.

1.4 WARRANTY

- A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Fire-Tube Condensing Boilers:
 - a. The pressure vessel/heat exchanger shall carry a 10-year nonprorated warranty from date of start up against any failure due to condensate corrosion, thermal stress, mechanical defects or workmanship.
 - b. Manufacturer labeled control panels shall be warranted against failure for two (2) years from start up.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Thermal Solutions – Arctic Series
 - 2. Bryan Boiler – FF Series
 - 3. RBI - Torus

2.2 CONSTRUCTION

- A. Description:
 - 1. Boiler shall be natural gas fired, fully condensing water tube design. Power burner shall have full modulation with a minimum 5:1 turndown ratio, and discharge into a positive pressure vent. Boiler efficiency shall increase with decreasing load (output), while

maintaining setpoint. Boiler shall be factory-fabricated, factory assembled and factory tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including insulated jacket, flue-gas vent, combustion air intake connections, water supply, return and condensate drain connections, and controls.

B. Heat Exchanger:

1. The heat exchanger shall be constructed of 316L stainless steel water tubes.
2. Heat exchanger to be ASME stamped for a working pressure not less than 160 psig.
3. Access to the tubesheet and heat exchanger shall be available by burner and exhaust manifold removal. Minimum access opening shall be not less than 10-inch diameter.

C. Pressure Vessel:

1. The pressure vessel shall have a maximum water volume of 50 gallons. The water pressure drop shall not exceed 5.5 psig at 258 GPM. The boiler water connections shall be 4-inch flanged 150-pound, ANSI rated. The pressure vessel shall be constructed of SA53 carbon steel, with a 0.25-inch thick wall and a 0.50-inch thick upper head.
2. Inspection openings in the pressure vessel shall be in accordance with ASM Section IV pressure vessel code.

D. Modulating Air/Fuel Valve and Burner:

1. The boiler shall be capable of a 5 to 1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves. The burner shall produce less than 30 ppm of NOx corrected to 3% excess oxygen. The unit shall be certified by the South Coast Air Quality Management District (SCAQMD) as compliant with Rule 1146.1 for boilers and water heaters greater than 2 MBTU's and less than 5MBTU's. The burner shall be metal-fiber mesh covering a stainless steel body with spark ignition and flame rectification. All burner material exposed to the combustion zone shall be of stainless steel construction. There shall be no moving parts within the burner itself. A modulating air/fuel valve shall meter the air and fuel input. The modulating motor shall be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment. A variable frequency drive (VFD), controlled cast aluminum pre-mix blower shall be used to ensure the optimum mixing of air and fuel between the air/fuel valve and the burner.

E. Exhaust Manifold:

1. The exhaust manifold shall be of corrosion resistant cast aluminum with an 8-inch diameter flue connection. The exhaust manifold shall have a collecting reservoir and a gravity drain for the elimination of condensation.

F. Blower:

1. The boiler shall include a variable speed, DC centrifugal fan to operate during the burner firing sequence and pre-purge the combustion chamber.

G. Ignition:

1. Ignition shall be via spark ignition with 100 percent main-valve shutoff and electronic flame supervision.

2.3 TRIM

- A. Safety Relief Valve: 50 psig ASME rated.
- B. Drain Valve: Minimum 0.75" hose-end ball valve.

2.4 CONTROLS

- A. The boiler control package shall be an integrated boiler management system capable of receiving signals from the building DDC system. The controls system shall be integral to each boiler, creating a control network that eliminates the need for a "wall mounted" stand-alone boiler control system.
- B. The boiler management control shall be capable of operating in the following ways:
 1. As a standalone boiler control system using its own control protocol with one "Master" and multiple "Member" units.
 2. As a boiler network, enabled by a Building Management System, using its own protocol with one "Master" and multiple "Member" units.
 3. As "Member" boilers to a Building Management System with multiple input control methods.
- C. Each boiler control panel shall be networked together and shall have the following standard features.
 1. Digital Communications Control
 - a. Boiler to Boiler: control panel protocol.
 - b. Building Management System: BACNET, coordinate with DDC system.
 2. Analog 4:20 and 010vdc also supported.
 3. Distributed control using boiler protocol for up to 16 total boilers.
 4. System/Boiler operating status in English text display.
 5. Interlock, Event, and System logging with a time stamp.
 6. Advanced PID algorithm optimized for specific boilers.
 7. Four (4) dedicated temperature sensor inputs for: Outside Air Temperature, Supply (Outlet) Temperature, Return Temperature (Inlet), and Header Temperature.

8. Flow Rate sensor.
9. Automatically detects the optional temperature sensors on start up.
10. Menu driven calibration and setup menus with display.
11. Eight (8) dedicated 24vac interlock monitors and eight (8) dedicated 120vac system monitors used for diagnostics and providing feedback of faults and system status.
12. Multiple boiler pump or motorized valve control modes.
13. Combustion Air Damper control with proof time.
14. USB/RS485 network plug-in to allow firmware updates or custom configurations.
15. BACNET interface.
16. Alarm contacts.
17. Runtime hours.
18. Outdoor Air Reset with programmable ratio.
19. Time of Day clock to provide up to four (4) night setback temperatures.
20. Failsafe mode when a Building Management System is controlling setpoint. If communication is lost, the boiler/system shall run off the local setpoint.

2.5 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.
- B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

2.6 VENTING KITS

- A. The exhaust vent shall be UL listed for use with Category III and IV appliances and compatible with operating temperatures up to 480 degrees F, positive pressure, condensing flue gas service. UL-listed vents of A1 29-4C stainless steel shall be used with boilers.
- B. The minimum exhaust vent duct size for each boiler shall be 8-inches diameter.
- C. Combustion Air Intake: Boilers shall be capable of drawing combustion air from the outdoors via an insulated metal duct connected between the boiler and the outdoors.

2.7 SOURCE QUALITY CONTROL

- A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 BOILER INSTALLATION

- A. Install boilers level on concrete base. Concrete base shall be installed by the HVAC contractor.
- B. Install gas-fired boilers according to NFPA 54.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with boiler but not specified to be factory mounted.
- E. Install control wiring to field-mounted electrical devices.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve.
- D. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- E. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.
- F. Install piping from safety relief valves to nearest floor drain.
- G. Route condensate piping to the nearest floor drain and provide neutralizing cartridge prior to discharge into floor drain. Flue drains are to be routed to condensate neutralizing cartridge with trap so flue gas does not escape.
- H. Boiler Venting:
 - 1. Install flue venting kit and combustion-air intake.

- I. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- J. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- K. See section 23 0993 for control sequence and operation.
- L. Connect boiler control panel to facility DDC system.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
 - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion. Provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 23 5216

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SECTION 23 6426 – AIR COOLED WATER CHILLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Packaged air-cooled chillers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Include plans, elevations, sections, details, clearance requirements and electrical requirements.
- C. Startup service reports.
- D. Operation and maintenance data.
- E. Warranty.

1.3 QUALITY ASSURANCE

- A. Chiller rating and performance shall be according to requirements of current ARI 550/590 standards.
- B. ASHRAE Compliance:
 - 1. ASHRAE 15 for safety code for mechanical refrigeration.
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004
- D. Comply with NFPA 70.
- E. Unit shall be UL or ETL listed.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - 1. Extended warranties include, but are not limited to, the following:
 - a. Complete compressor and drive assembly

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PACKAGED, AIR-COOLED CHILLERS

- A. Manufacturers: Subject to compliance with requirements Trane, Carrier or Daikin.
- B. Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
- C. Fabricate base, frame, and attachment to chiller components strong enough to resist chiller movement during a seismic event when chiller base is anchored to field support structure.
- D. Cabinet:
 1. Base: Galvanized-steel base extending the perimeter of chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
 2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported by base.
 3. Casing: Galvanized steel.
 4. Finish: Base, frame, and casing shall be finished with an enamel paint finish.
 5. Sound-reduction package designed to reduce sound level without affecting performance and consisting of the following:
 - a. Acoustic jacket enclosure around compressors.
- E. Compressors- Scroll:
 1. The compressors shall be sealed hermetic, direct drive, fixed compression, scroll type with crankcase oil heater and suction strainer. The compressors shall be equipped with an internal module providing compressor protection and communication capability.
 2. Each compressor to have centrifugal oil pump, oil level sight glass, oil charging valve and check valve on the discharge.
 3. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads.
 4. Multiple compressors staged on-off for capacity control, minimum of four compressors and dual refrigerant circuits.
- F. Service: Easily accessible for inspection and service.
- G. Capacity Control: On-off compressor cycling and or modulating slide-valve assembly to achieve performance indicated.

1. Maintain stable operation throughout range of operation from 20% to 100% of capacity. Configure to achieve most energy-efficient operation possible.
 2. For units equipped with a variable frequency controller, capacity control shall be both "valveless" and "stepless," requiring no slide valve or capacity-control valve(s) to operate at reduced capacity.
- H. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.
1. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
 2. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
 3. Factory-installed and pressure-tested piping with isolation valves and accessories.
 4. Oil compatible with refrigerant and chiller components.
 5. Positive visual indication of oil level.
- I. Vibration Control:
1. Vibration Balance: Balance chiller compressors and drive assemblies to provide a precision balance that is free of noticeable vibration over the entire operating range.
 - a. Overspeed Test: 25 percent above design operating speed.
 2. Isolation: Mount individual compressors on vibration isolators.
- J. Compressor Motors:
1. Hermetically sealed and cooled by refrigerant suction gas.
 2. High-torque, induction type with inherent thermal-overload protection on each phase.
- K. Compressor Motor Controllers:
1. Across the Line: NEMA ICS 2, Class A, full voltage, non-reversing, or solid state.
 2. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition, or solid state.
- L. Refrigerant Circuits:
1. Refrigerant: R410A
 2. Refrigerant Circuit: Each shall include refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 3. Pressure Relief Device:
 - a. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b. ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.
- M. Evaporator:

1. Description: Brazed Plate.
 - a. Direct Expansion, high efficiency, dual circuit, brazed plate design.
 - b. Type 316 Stainless Steel construction.
 - c. Vent and drain connection on chilled water piping by installing contractor.
2. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Fluid Nozzles: Terminated with mechanical-coupling end connections for connection to field piping.
4. The evaporator shall be protected with an external, electric resistance heater plate. The evaporator and suction piping to the compressors shall be insulated with 3/4" (19 mm) thick CFC and HCFC-free closed-cell flexible elastomeric foam insulation material with 100% adhesive coverage. The insulation shall have an additional outer protective layer of 3mm thick PE embossed film to provide superior damage resistance. Insulation without the protective outer film shall not be acceptable. UV resistance level shall meet or exceed a rating of 'Good' in accordance with the UNI ISO 4892 - 2/94 testing method. This combination of a heater plate and insulation shall provide freeze protection down to -20°F (-29°C) ambient air temperature.
5. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.

N. Air-Cooled Condenser:

1. Coils: Microchannel coil with integral subcooling on each circuit.
 - a. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds.
 - b. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted.
 - c. Coils shall consist of a two-pass arrangement.
 - d. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.
2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
3. Fan Motors: Totally enclosed non-ventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings. Equip each motor with overload protection integral to either the motor or chiller controls.
4. Fan Guards: Steel safety guards with corrosion-resistant coating.

O. Electrical Power:

1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point, field-power connection to chiller.
2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door
3. Wiring shall be numbered and color-coded to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.
5. Field-power interface shall be to wire lugs.

6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - b. NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
 7. Provide each motor with overcurrent protection.
 8. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
 9. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.
 10. Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - a. Power unit-mounted controls where indicated.
 - b. Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.
 11. Control Relays: Auxiliary and adjustable time-delay relays.
 12. For chiller electrical power supply, indicate the following:
 - a. Current and phase to phase for all three phases.
 - b. Voltage, phase to phase, and phase to neutral for all three phases.
 - c. Three-phase real power (kilowatts).
 - d. Three-phase reactive power (kilovolt amperes reactive).
 - e. Power factor.
 - f. Running log of total power versus time (kilowatt-hours).
 - g. Fault log, with time and date of each.
- P. Controls:
1. DDC Microprocessor based with LCD display.
 2. Enclosure: Share enclosure with electrical power devices.
 3. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:
 - a. Date and time.
 - b. Operating or alarm status.
 - c. Operating hours.
 - d. Outdoor-air temperature if required for chilled-water reset.
 - e. Temperature and pressure of operating set points.
 - f. Entering and leaving temperatures of chilled water.
 - g. Refrigerant pressures in evaporator and condenser.
 - h. Saturation temperature in evaporator and condenser.
 - i. No cooling load condition.
 - j. Elapsed time meter (compressor run status).
 - k. Pump status.
 - l. Antirecycling timer status.
 - m. Percent of maximum motor amperage.

- n. Current-limit set point.
 - o. Number of compressor starts.
 - p. Normal or Ice making mode of operation.
4. Control Functions:
- a. Manual startup and shutdown.
 - b. Entering and leaving chilled-water temperatures, control set points, and motor load limits. Chilled-water leaving temperature shall be reset from the DDC system
 - c. Current limit and demand limit.
 - d. External chiller emergency stop.
 - e. Anti recycling timer.
 - f. Automatic lead-lag switching.
5. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:
- a. Low evaporator pressure or high condenser pressure.
 - b. Low chilled-water temperature.
 - c. Refrigerant high pressure.
 - d. High or low oil pressure.
 - e. High oil temperature.
 - f. Loss of chilled-water flow.
 - g. Control device failure.
6. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
7. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
8. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
9. BAS Interface: Factory-installed hardware and software to enable the Bacnet BAS to monitor, control, initiate/terminate ice building mode and display chiller status and alarms.
- a. Hardwired Points:
 - 1) Monitoring: On-off status, common trouble alarm
 - 2) Control: On-off operation, chilled-water, discharge temperature set-point adjustment, normal/ice making mode of operation
 - b. Coordinate communication interface with the DDC shall enable the DDC operator to remotely control and monitor the chiller from an operator workstation. Major control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.

Q. Insulation:

- 1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

2. Thickness: 1-1/2 inches.
3. Factory-applied insulation over cold surfaces of chiller components.
 - a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
4. Apply protective coating to exposed surfaces of insulation to protect insulation from weather.

R. Accessories:

1. Factory-furnished, chilled-water flow switches for field installation.
2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.

2.2 SOURCE QUALITY CONTROL

- A. Perform functional tests of chillers before shipping.
- B. Factory test and inspect evaporator according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 3 - EXECUTION

3.1 CHILLER INSTALLATION

- A. Install chillers on grade mounted concrete pad provided by the General Contractor.
- B. Maintain manufacturer's recommended clearances for service and maintenance.
- C. Charge chiller with refrigerant and fill with oil if not factory installed.
- D. Install separate devices furnished by manufacturer and not factory installed.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to chiller to allow service and maintenance.
- C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage and drain connection with valve. Make connections to chiller with a mechanical coupling.
- D. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
 2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
 3. Verify that pumps are installed and functional.
 4. Verify that thermometers and gages are installed.
 5. Operate chiller for run-in period.
 6. Check bearing lubrication and oil levels.
 7. For chillers installed indoors, verify that refrigerant pressure relief device is vented outdoors.
 8. Verify proper motor rotation.
 9. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
 10. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
 11. Verify and record performance of chiller protection devices.
 12. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- E. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
- F. Prepare test and inspection startup reports.

END OF SECTION 23 6426

SECTION 23 7313 - MODULAR INDOOR AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Factory assembled air handling units.

1.2 SUBMITTALS

A. Product Data: For each air-handling unit indicated.

1. Unit dimensions and weight.
2. Cabinet material, metal thickness, finishes, insulation, and accessories.
3. Fans:
 - a. Certified fan-performance curves with system operating conditions indicated.
 - b. Certified fan-sound power ratings.
 - c. Fan construction and accessories.
 - d. Motor ratings, electrical characteristics, and motor accessories.
4. Certified coil-performance ratings with system operating conditions indicated.
5. Dampers, including housing, linkages, and operators.
6. Filters with performance characteristics.

B. Operation and maintenance data.

1.3 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. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- F. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 UNIT CASINGS & CONSTRUCTION

- A. Casings to house the various components shall be double-wall construction. Sections shall have bolted intervening connections. Casings and parts shall be galvanized sheet steel throughout, or sheet steel chemically cleaned, phosphatized, and painted on the exterior with enamel. Utilize intermediate structural channel stiffeners for L/240 deflection.
- B. Interior liner – G90 galvanized steel construction, except for cooling coil sections which are to be stainless steel construction.
- C. Outer panel – G90 galvanized construction, primed and painted by manufacturer.
- D. Side panels of all modular sections shall be removable with two or more camlock type locks, fully gasketed around the entire perimeter of the panel. Panel size shall be large enough to allow maintenance and or replacement of internal components.
- E. Low Leakage – Shall not exceed ASHRAE 111 Class 6 or be 1% of supply air volume at design static operating pressure.
- F. Double Wall – thermally broken double wall assembly.
 - 1. Thickness: 2” thick panels, solid metal inside and out
 - 2. Insulation: 2” spray injected foam = R-13
- G. Floor Plate – 0.044” thick aluminum tread plate in walk in sections.
- H. Access Doors:
 - 1. Access Doors:
 - a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - a. Construction: Double wall insulated.
 - b. All doors shall have round glass vision panels.
 - c. Doors shall be 6” shorter than the height of the unit, or 72” max. height.
 - 2. Locations:
 - a. Access doors shall be provided at a minimum in the following locations and where otherwise indicated in the drawings.
 - b. Verify that the sections listed below are large enough for panels and doors. Verify applicability with listed manufacturers.
 - c. Fan Sections
 - d. Access Sections
 - e. Cooling Coil Drain Pan
 - f. Filter Section

g. Mixing Section

I. Interior Lighting.

1. Unit manufacturer shall furnish, install, and wire a complete lighting system to one (1) identified 120-volt feed location junction box for wiring and switching by the E.C.
2. Light Fixtures for unit sections
 - a. Construction – Diecast aluminum with bayonet guard, vapor tight, LED marine type, service light pendant fixture. Heat and shock resistant glass or polycarbonate globe.
 - b. Quantity - Each access section shall be provided with a minimum of one (1) light fixture. Fan sections and filter sections shall be provided with a minimum of two (2) light fixtures. Units shipped with LED bulbs.
3. Locations: Ceiling of access sections, plenums, filter, and fan sections. Sidewall if no room on ceiling of section.

J. Base Rail

1. The casing sections shall be assembled on full length heavy gauge G60 galvanized steel base rails.
 - a. 8” high for AHU-1.
 - b. 6” high for AHU-2.

2.2 FAN, DRIVE, AND MOTOR SECTION

A. ECM Fan Array

1. Description: Fan section(s) shall contain fan, motor, drive components and accessories. Motor and drive shall be mounted with the casing and isolated. with electronically commutated motor (ECM). Fan array to be UL 1995 listed. See fan duty and HP requirements listed on the drawing.
2. Fans: Direct drive, high efficiency, backward inclined plenum type. Galvanized or aluminum support frame.
 - a. Fan material to be welded aluminum or high-performance composite impeller.
 - b. Manual blank-off plates shall be provided to block fan airflow, one plate to be provided per array. Backdraft dampers shall be provided to block fan airflow in lieu of blank-off plates.
3. Integrated Drive: Drive shall be provided for each fan array. Drive to be mounted on door side of fan section and to include fused disconnect with a motor starter. Drives are to be accessible through a hinged door assembly complete with a single handle latch. The unit manufacturer shall install all power and control wiring.
 - a. The drive output shall be controlled by the factory installed main unit control system and drive status operating speed shall be monitored and displayed on the

- main unit control panel. The supply and return fan drive outputs shall be independently controlled to provide the control needed to maintain building pressure control.
- b. Control Panel: Provide a single control panel consisting of motor overloads, one for each fan, and DDC control input for fan modulation.
 - 1) All power and control wiring from control panel shall be provided by the unit manufacture as specified above.
 - 2) Panel shall be designed and wired to accept a single point power and controls connection by the respective trade contractors.
 - 3) External disconnect shall be UL or ETL listed. The panel shall be provided with a BACnet compatible controller capable of monitoring the array's airflow, total static pressure, power consumption, RPM, and individual fan alarm status and specific cause of alarm. Controller shall be configurable for fan speed control via BACnet interface (MS/TP), 0-10 VDC input, 4-20 mA input, constant airflow, or duct static pressure (static pressure sensor to be field provided and mounted). Control panel shall be equipped with relays for locking between other electrically driven components. There is a system alarm contact that the BAS can use to check the status of the proprietary controller. There is a system enable contact that the BAS can use to enable or disable the System, along with a safety circuit terminations.
 - c. All drives shall be factory run tested prior to unit shipment.
4. Bulkhead Construction: The fan bulkhead wall shall be constructed of:
- a. The panels walls shall be minimum 20-gauge galvanized steel and add structure to prevent vibration and "oil canning" of bulkhead wall. Minimum 1" foam injected panel. **Bulkhead walls constructed of non-insulated sheet metal assemblies shall not be acceptable.**
 - b. 14-gauge galvanized steel with bend profile at each panel seam for vertical structural support.
5. ECM Motors:
- a. The fans are driven by long-life, low-temperature brushless DC electronically commutated motor (EC-Motor) with external rotor and integrated maintenance-free electronic circuitry and electronics. The motor is manufactured with maintenance-free, permanently lubricated ball bearings and shall be statically and dynamically balanced in accordance with ISO 1940 part 1. The motor shall be closed, protection level IP 54, thermal class 155 with permissible operating temperature of -13°F to 140°F. Motor efficiency class shall comply with IE4. Fan characteristic curves indicate measurements on a chamber test in accordance with ISO5801. The three-phase external rotor motor integrated into the fan hub meets the requirements for circulating electric machines set forth in DIN EN 60 034-1 (VDE 0530 Part 1).
 - b. Motor shall be "premium efficiency" series. Refer to Section 23 0513 Electrical Requirements for HVAC Equipment.
 - c. Motors which are fed from variable frequency drive controllers for variable speed operation shall be designed and constructed for VFD drive duty and shall contain shaft grounding rings by Aegis.

6. Vibration isolation: Fan and motor assembly shall be provided with internal vibration isolation to the fan casing. Vibration isolators shall be steel spring type, 2" static deflection.
7. Bearings, Shafts and Drives: Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
8. Designed to operate at no more than 70 percent of the first critical speed at top of fan's speed range.

2.3 COIL SECTIONS

A. General Requirements for Coil Sections:

1. Comply with ARI 410.
2. Fabricate the coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. For multizone units, provide air deflectors and air baffles to balance airflow across coils.
4. Coils shall not act as structural component of unit.

B. Heating Coils

1. Heating coil(s) shall be hot water type with copper tubes with 0.020" minimum wall thickness, aluminum fins, copper supply and return headers, and stainless-steel casing.
2. Capped stainless drain pan.

C. Cooling Coils

1. Cooling coil(s) shall be chilled water type with copper tubes with 0.020" wall thickness, aluminum fins, supply and return headers and stainless-steel casing.

D. Drain Pans

1. A drain pan shall be incorporated in sections containing cooling coils, heating coils, first section downstream of cooling coil, outside air intake openings, access sections between coils and other sections so noted in the drawings.
2. The drain pan shall be double wall with insulation between. Interior liner shall be stainless steel for cooling coils. Others shall be galvanized steel. The drain pan shall be sloped in two directions and have a tapped drain outlet at that side of the pan. Cap all sections beside the cooling coil drain pan.

2.4 AIR FILTRATION SECTION

- A. Filter types and efficiencies shall be as indicated in the Air Handling Unit Schedule and details. Filter dimensions shall be 12"x24" or 24"x24".
- B. The filter bank shall be designed for a maximum face velocity of 500 fpm.

- C. Two complete sets of pre-filters and two complete sets of final filters shall be provided by the air handling unit manufacturer for each unit that are to be installed upon project completion. The H.C. shall provide additional filters as required for running the air handling unit during construction, if so required.
- D. Filters shall be shipped direct to the job site independent of the air handling unit.
- E. Differential Pressure Gauges – Provide Mechanical Dwyer #Minihelic II upstream and downstream of filter section mounted to exterior of unit with 0-3” w.c. gradation.
- F. Pre-Filters
 - 1. Minimum efficiency of MERV 8, in accordance with ASHRAE 52.1
 - 2. Pre-filters shall be 2” deep.
 - 3. Disposable cartridges fabricated of reinforced synthetic fibers bonded to a resistant water resistant and incombustible carton frame.
 - 4. Manufactured according to the standards established by UL class II.
 - 5. Pre-filters shall be Camfil-Farr 30/30 or equal by AAF.
- G. Final Filters
 - 1. Minimum efficiency of MERV 13, in accordance with ASHRAE 52.1
 - 2. Final filters shall be 4” deep.
 - 3. Disposable cartridges fabricated of reinforced synthetic fibers bonded to a resistant water resistant and incombustible carton frame.
 - 4. Manufactured according to the standards established by UL class II.
 - 5. Final filters shall be Camfil-Farr Riga-Flo or equal by AAF.

2.5 ECONOMIZER/MIXING SECTION

- A. The mixing section shall consist of a casing with outside air dampers, vent air dampers and return air dampers. Dampers shall be aluminum air foil blades equipped with external linkage for automatic control, vinyl or neoprene blade edge seals and metal compressible jamb seals. AMCA certified with a maximum leakage of 12 cfm/sq.ft at 4” w.g. differential pressure. Maximum blade length shall be 60 inches. Provide access doors as indicated on the drawings or as required for damper access.
- B. Arrangement of outside air dampers and return air dampers shall be:
 - 1. Outside Air Damper: Opposed blade
 - 2. Return Air Damper: Opposed blade

2.6 ACCESS SECTIONS

- A. Access sections shall be provided between components to allow easy access for maintenance.

2.7 PLENUM SECTIONS

- A. Plenum sections shall be provided and properly sized for inlet and/or discharge air flow between 600 and 1500 fpm. Plenum shall provide single or multiple openings as shown on drawings and project schedule.

2.8 ELECTRICAL

- A. The air handler(s) shall be ETL and ETL-Canada listed by Intertek Testing Services, Inc. Units shall conform to bi-national standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.
- B. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.
- C. Manufacturer shall provide ASHRAE 90.1 Energy Efficiency equation details for individual equipment to assist Building Engineer for calculating system compliance.
- D. Installing contractor shall provide GFI receptacle within 25 feet of unit to satisfy National Electrical Code requirements.

2.9 MANUFACTURERS

- A. Manufacturers:
 - 1. Daikin
 - 2. Trane
 - 3. Carrier
 - 4. Temtrol

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Each floor set unit shall be mounted on a concrete housekeeping pad as shown on the drawings. Concrete pads shall be provided by the HVAC Contactor. Coordinate location and dimensions of the unit and mounting elements with other trades.
- B. Arrange installation of units to provide access space around air-handling units for service and maintenance.
- C. Do not operate the fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- D. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- E. Install piping adjacent to the air-handling unit to allow service and maintenance to access doors or removable panel sections.
- F. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.
- G. Connect condensate drain pans using Type M copper tubing. Extend to nearest equipment or floor drain. Construct a deep trap at connection to drain pan and install cleanouts at changes in direction.
- H. Hot- and Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
- I. Connect ductwork to air-handling units with flexible connections. Comply with requirements in Division 23 Section "Air Duct Accessories."

END OF SECTION 23 7313

SECTION 23 8146 - WATER-SOURCE UNITARY HEAT PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of water-source heat pumps:
 - 1. Concealed horizontal or vertical units.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each model.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and maintenance data.
- E. Special warranties.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance:
 - 1. ASHRAE 15.
 - 2. Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. Comply with NFPA 70.
- E. Comply with safety requirements in UL 484 for assembly of free-delivery water-source heat pumps.
- F. Comply with safety requirements in UL 1995 for duct-system connections.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace refrigeration components of water-source heat pumps that fail in materials or workmanship within five 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 - 1. Daikin.
 - 2. Carrier Corporation.
 - 3. Trane.
- B. Description: Packaged water-source heat pump with temperature controls; factory assembled, tested, and rated according to AHRI-ISO-13256-1.
- C. Cabinet and Chassis: G-60 Galvanized-steel casing with the following features:
 - 1. Access panel for access and maintenance of internal components.
 - 2. Knockouts for electrical and piping connections.
 - 3. Flanged duct connections.
 - 4. Cabinet Insulation: Glass-fiber liner, minimum 1/2 inch thick, complying with UL 181.
 - 5. Condensate Drainage: Stainless-steel drain pan with condensate drain piping projecting through unit cabinet and complying with ASHRAE 62.1.
 - 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - 7. Sound Attenuation Package:
 - a. Sound attenuating blanket over compressor.
- D. Fan: Direct driven, centrifugal, with multispeed motor resiliently mounted in fan inlet.
 - 1. General requirements for motors are specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 2. Motor: Multispeed, permanently lubricated, ECM motor.
- E. Water Circuit:
 - 1. Refrigerant-to-Water Heat Exchangers: Coaxial heat exchangers with copper water tube with enhanced heat-transfer surfaces inside a steel shell.
 - 2. The coil shall be constructed to a working pressure of 500 psig on the waterside, and 600 psig on the refrigerant side.
 - 3. Motorized Water Valve: Stop water flow through the unit when compressor is off.
- F. Refrigerant-to-Air Coils: Copper tubes with aluminum fins.

G. Refrigerant Circuit Components:

1. Sealed Refrigerant Circuit: Charge with R-410A refrigerant.
2. Charging Connections: Service fittings on suction and liquid for charging and testing.
3. Reversing Valve: Pilot-operated sliding-type valve designed to be fail-safe in heating position with replaceable magnetic coil.
4. Compressor: Hermetic two stage scroll compressor installed on vibration isolators and housed in an acoustically treated enclosure with factory-installed safeties as follows:
 - a. Antirecycle timer.
 - b. High-pressure cutout.
 - c. Low-pressure cutout or loss of charge switch.
 - d. Internal thermal-overload protection.
 - e. Low Refrigerant Suction Sensor
 - f. Condenser Water Flow switch
 - g. Condensate overflow switch to stop compressor with high condensate level in condensate drain pan.
 - h. Leaving condensate water piping temperature sensor.
5. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
6. Pipe Insulation: Refrigerant minimum 3/8-inch- thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-development indexes according to ASTM E 84.
7. Refrigerant Metering Device: Capillary tube.
8. Refrigerant Metering Device: Thermostatic expansion valve

H. Hot-Gas Reheat: Unit(s) shall have dehumidification control using hot gas refrigerant reheat system. Reheat coil shall be aluminum microchannel hot gas reheat located downstream of the cooling coil.

I. Filters: 2" low leakage rack with 2" MERV 8 Filters.

J. Controls:

1. Unit shall be provided with a factory mounted microprocessor based unit controller and have the capability of performing the sequence of control listed on the drawings. The following features shall also be incorporated.
 - a. Condensate Overflow
 - b. Condenser water flow sensor
 - c. Condenser water solenoid valve
 - d. Air filter differential pressure
 - e. Brownout Detection
 - f. Suction-Line Temp Sensor
 - g. Timed override switch
2. The controller shall be provided with an I/O expansion board providing a means of adding I/O capabilities to the base controller.

3. BACnet Communications Module – The unit control shall communicate over BACnet communications network. The unit shall be capable of supporting full MSTP BACnet implementation. The physical interface to a BACnet BAS network shall be through an industry standard RS-485 transceiver capable of existing on an RS-485 network of up to 64 nodes.
 4. Wall Mounted Temperature Sensor – Digitally Adjustable Display Sensor with LED display showing room temperature, room humidity, fan speed, system mode, and override occupancy. The dehumidification output contact shall have an adjustable set point and configurable deadband.
- K. Electrical Connection: Single electrical connection with non-fused disconnect, with factory mounted and wired low voltage transformer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Concrete Bases: Install floor mounting units on 4-inch high concrete bases.
- B. Suspend water-source heat pumps from structure with threaded steel rods and vibration isolators.
- C. Install wall-mounting thermostats, and switch controls in electrical outlet boxes at heights to match lighting controls.
- D. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
 1. Connect supply and return hydronic piping to heat pump with shut off valves and flexible hose connections.
 2. Connect heat-pump condensate drain pan to indirect waste connection with condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.
- E. Install electrical devices furnished by manufacturer but not specified to be factory mounted.
- F. Install piping adjacent to machine to allow service and maintenance.

END OF SECTION 23 8146

SECTION 23 8239 - UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Cabinet unit heaters.
 2. Propeller unit heaters.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Equipment schedules to include rated capacities, furnished specialties, and accessories.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

PART 2 - PRODUCTS

2.1 CABINET UNIT HEATERS

- A. Fan: Direct driven centrifugal with multi-speed permanent split capacitor motor having internal overload protection.
- B. Electrical Disconnect:
1. Toggle disconnect switch furnished and mounted inside the cabinet.

- C. Heating Coil: Seamless copper tubes with bonded aluminum fins, hydrostatically tested at 300 psi.
- D. Cabinet:
 - 1. Exposed units shall be constructed of galvanized steel, 16 gauge front and 20 gauge back and sides, with outlet and inlet grille as appropriate. Recessed units shall have overlapping cabinet or wall flange on all four corners. Exposed and recessed units shall have lockable access door.
 - a. Finish shall be baked enamel of colors selected by the Architect from the manufacturer's standard decorator colors.
 - 2. Concealed units shall have a discharge duct collar and where return duct is required, a return duct collar.
- E. Filter: 1" pleated media throwaway, MERV 7 (Farr 30/30)
- F. Controls: Low voltage transformer, unit on-off power switch, 24v 2-way position ball valve and wall mounted thermostat.
- G. Manufacturers:
 - 1. Airtherm.
 - 2. Carrier Corporation.
 - 3. Dunham-Bush, Inc.
 - 4. Trane.

2.2 PROPELLER UNIT HEATERS

- A. Fan: Direct driven propeller fan and single speed permanent split capacitor motor with internal overload protection. Units shall have a wire fan guard.
- B. Electrical Disconnect:
 - 1. Toggle disconnect switch furnished and mounted on cabinet.
- C. Heating Coil: Seamless copper tubes with bonded aluminum fins, hydrostatically tested at 300 psi.
- D. Cabinet: Galvanized steel, 18 gauge, with baked enamel finish. Horizontal units shall be equipped with adjustable discharge louvers.
- E. Controls: Low voltage transformer, on-off switch, 24v 2-way 2 position ball valve and wall mounted thermostat.
- F. Manufacturers:
 - 1. Airtherm.
 - 2. Dunham-Bush
 - 3. Rittling

4. Modine.
5. Trane.
6. Daikin.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to drawings for arrangement, type, capacity, motor characteristics and other requirements.
- B. Install unit heaters to comply with NFPA 90A.
- C. Suspend unit heaters, all four corners, from building structure with steel hanger rods and auxiliary angles and fastening devices.
- D. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
- E. Wiring between the unit and wall mounted thermostats shall be run in conduit, furnished and installed by the HVAC contractor. See Section 23 0914 "Control Wiring".
- F. Install new filters in each fan-coil unit within two weeks of Substantial Completion.
- G. Install piping adjacent to machine to allow service and maintenance.

END OF SECTION 23 8239

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DIVISION 26 ELECTRICAL

26 0000 General Requirements for Electrical Systems

- 26 0001 Basic Electrical Requirements
- 26 0002 Electrical Work in Existing Buildings
- 26 0004 Firestopping for Electrical Systems
- 26 0005 Excavation, Backfill and Surface Restoration

26 0500 Common Work Results for Electrical

- 26 0519 Low-Voltage Electrical Power Conductors and Cables
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- 26 0526 Grounding and Bonding for Electrical Systems
- 26 0529 Hangers and Supports for Electrical Systems
- 26 0533 Raceway and Boxes for Electrical Systems
- 26 0537 J-Hook Pathways for Electrical Systems
- 26 0543 Underground Ducts and Raceways for Electrical Systems
- 26 0553 Identification for Electrical Systems
- 26 0563 Specific Wiring Applications

26 0900 Instrumentation and Control for Electrical

- 26 0923 Lighting Control Devices
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26 2000 Low-Voltage Electrical Distribution

- 26 2213 Low-Voltage Distribution Transformers
- 26 2413 Switchboards
- 26 2416 Panelboards
- 26 2726 Wiring Devices
- 26 2813 Fuses
- 26 2816 Enclosed Switches and Circuit Breakers

26 3000 Facility Electrical Power Generating and Storing Equipment

- 26 3213 Engine Generators (Diesel Fueled)
- 26 3623 Automatic Transfer Switches

26 4000 Electrical Cathodic Protection

- 26 4113 Lightning Protection for New Buildings
- 26 4313 Surge Protective Devices (SPD) for Low-Voltage Electrical Power Circuits

26 5000 Lighting

- 26 5113 Interior Lighting Fixtures
- 26 5200 Exit and Emergency Lighting
- 26 5600 Exterior Area Lighting

26 6000 Electronic Safety and Security

26 6101 Fire Detection and Alarm System

SECTION 26 0001 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the following:

1. General Requirements
2. Definitions
3. Scope of Work
4. Drawings and Specifications
5. Reference Standards
6. Allowances, Unit Prices and Alternates
7. Site Visit
8. Permits, Regulations and Inspections
9. Project Management and Coordination
10. Temporary Electric Services
11. Workmanship
12. Protection
13. Painting
14. Cleaning
15. Equipment Selection
16. Shop Drawings
17. Testing
18. Final Inspection and Punch List
19. Operation and Maintenance Manuals
20. Record Drawings
21. Warranties
22. Operation and Adjustment of Equipment
23. Operating Demonstration and Instruction

1.2 GENERAL REQUIREMENTS

- A. All provisions of Division 00 Front End Documents and Division 01 General Requirements apply to work specified in this Division.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this Electrical work.
- C. A complete and functional Electrical system installation shall be provided under this Division. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

- D. The Mechanical and Electrical drawings and specifications assign work (labor and/or materials to be provided by the General, Plumbing, Fire Suppression, HVAC or Electrical Contractor or their sub-contractors. Understanding that the contractors for mechanical and electrical work are sub-contractors to the (General) Contractor, such assignments are not intended to restrict the Contractor in assignment of work among the sub-contractor to accommodate trade agreements and practices or the normal conduct of the construction work.

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 SCOPE OF WORK

- A. The scope of the electrical work includes furnishing, installing, testing and warranty of all electrical work and complete electrical systems shown on the electrical drawings and specified herein, including Division 00, Division 01, Division 26 and applicable provisions of other relevant Divisions.

1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word "provide", as used shall mean "furnish and install". If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.
- B. Make all necessary field measurements to insure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having equipment, wireways and fittings

fabricated and delivered in advance of making actual measurements shall not be sufficient cause to avoid making offsets and minor changes as may be necessary to install wireways, fittings and equipment.

- D. The Architect shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.
- E. Equipment, ductwork and piping shall not be installed in the dedicated electrical space above or in the working space required around electrical switchgear, motor control centers or panelboards as identified by NEC 110.26 Spaces About Electrical Equipment – 600 Volts Nominal or Less. For Equipment rated over 600 volts nominal – 110.32 Work Space About Equipment – 110.33 Entrance and Access to Work Space – 110.34 Work Space and Grounding. The Electrical Contractor shall caution other trades to comply with this stipulation.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the Contractor causing such conflict. The Architect's decision shall be final in regard to arrangement of equipment, conduit(s), devices, wireways etc., where conflict arises.
- G. Provide offsets in system runs, additional fittings, necessary conduit, pull boxes, conductors, switches and devices required to complete the installation, or for the proper operation of the system. Each contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved from the work which is specified under his branch until instructions in writing are received from the Architect.

1.6 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ASTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.7 ALLOWANCES, UNIT PRICES AND ALTERNATES

- A. Refer to Sections 012100 Allowances, 012200 Unit Prices and 012300 Alternates.

1.8 SITE VISIT

- A. Refer to Section 017300 Execution.

- B. Each bidder shall visit the project site to understand the existing conditions and compare the conditions with information shown on the drawings. Report immediately to the Architect any issues or discrepancies which are discovered that affect the bid. Changes to contract price will not be considered for site condition issues that are readily apparent from a thorough site review.

1.9 PERMITS, REGULATIONS AND INSPECTION

- A. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.
- B. Except where the permit application is made by the Architect or the Engineer, the Electrical contractor shall be responsible to file for and obtain all required permits from the governing inspection agencies for the Electrical work. Where the Architect or Engineer is the Architect or Engineer of record, they will furnish sealed and signed drawings and specifications required by the permit authorities except fire alarm permit documents shall be prepared and submitted by an approved, licensed fire alarm subcontractor.
- C. Include payment of all permit and inspection fees applicable to the work in this Division.
- D. All work shall be subject to inspection and approval of Federal, State and local agencies as may be appropriate as well as the Architect and Engineer.
- E. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.10 PROJECT MANAGEMENT AND COORDINATION

- A. The HVAC Contractor shall initially prepare and be responsible for ¼" scale coordination drawings. These drawings shall be reproduced and distributed to the Plumbing, Fire Suppression and Electrical Contractors for their input and revisions. Assure that all contractors work together to obtain finish coordinated drawings and no work being installed until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Engineer.
- B. The E.C. shall review the Architect's drawings to coordinate the project phasing in the existing building and shall closely coordinate the demolition and re-feed of existing and new services to minimize required downtime and outages in and adjacent to remodeled areas as directed by the Architect and Owner. The E.C. shall review existing conditions and communicate expected interruptions to allow the Owner to coordinate and schedule facility operations to accommodate accordingly or to require off-hour/weekend/Holiday work.

1.11 TEMPORARY ELECTRIC SERVICES

- A. Refer to Section 015000 – Temporary Facilities and Controls for division of responsibilities for temporary utilities.

- B. The temporary service and temporary lighting for construction is provided by the Electrical Contractor.
- C. The Electrical Contractor is cautioned to carefully consider the possible sources of temporary electric service (anticipated to be fed from the existing building electric service switchboard in the basement) and the probable location of the General Contractor's office.
- D. The Electric Contractor shall furnish, install and pay for all necessary conduit, wire, metering, poles, switches, receptacles, lights and accessories to provide a 400 amp, 120/230 volt, 3 phase, 4 wire temporary electric service with the main disconnect switch, meter, and a 42 circuit load center at a location specified by the General Contractor.
- E. Consult the utility company for fees required and include same in Electrical Contract.
- F. Labor, receptacles, boxes, fixtures, wire, etc. required by the various Contractors inside their offices shall be paid for by the respective Contractors.
- G. Lighting fixtures shall be placed every 40 ft. along each corridor or where corridors do not occur, along the long axis of all rooms. Provide a minimum 800 lumen lamp in a commercial grade molded plastic socket and lattice wire guard temporary lighting assembly with extra heavy duty "ST" 3-wire cord. Lamps shall be spaced a minimum of 10 ft. apart. For large open areas or during the early stages of construction, 250 watt metal halide fixtures (or LED equivalent) with wire guards may be utilized. Receptacle circuits shall consist of 1-gang cast "FS" type box with grounded duplex receptacles a maximum of 50 ft. on center with a maximum of 4 per circuit. All receptacle circuits shall be protected by its own overcurrent device in a panel board. Install wiring and equipment above 6'-6" and below the finished ceiling. Extend circuits as required. Provide GFCI protected receptacles and circuits as required by NEC and OSHA.
- H. Contractors requiring extension cords shall provide their own cords and plugs up to capacity of 20 amperes. For services to larger items of equipment and welders, this Contractor shall extend proper feeders as requested at the expense of the Contractors requiring the service.
- I. The Electrical Contractor shall maintain the temporary light and power system for the duration of the work and shall remove it from the site when directed. Temporary wiring and equipment shall remain the property of the Electrical Contractor.
- J. The use of the permanent electrical system for temporary services during the latter stages of construction shall be allowed. Expedite completion of system as practicable to this end. Maintain the system during this period.
- K. Warranty periods on equipment, materials and systems shall commence upon Owner acceptance of the building or systems. Temporary use shall not jeopardize or alter warranty requirements.
- L. The complete temporary service shall comply with Power Company, OSHA, and all Code requirements.

1.12 WORKMANSHIP

- A. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect shall have the right to stop the work if highest quality workmanship is not maintained.
- B. Electrical work shall be performed by a licensed Electrical Contractor in accordance with requirements of the jurisdiction.

1.13 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide plastic sheeting, drop cloths or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.
- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of ducts, piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.14 PAINTING

- A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in the Electrical Contract:
 - 1. All metal which is not factory or shop painted and which remains exposed to view in the building including finished areas, mechanical rooms, storage rooms and other unfinished areas shall be given a prime coat of paint.
 - 2. All metal installed outside the building which is not factory or shop painted shall be given a prime coat of paint.
 - 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated,

shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.

4. Apply Z.R.C. Cold Galvanizing Compound, or approved equal, for touch-up of previously galvanized surfaces.
5. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 09 Finishes. All rust must be removed before application of paint.

- B. Finish painting is included in the General Contract. Refer to the Cutting and Patching paragraph in this Section for finishing requirements.

1.15 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain.
- D. Before placing each system in operation, the equipment shall be thoroughly cleaned; cleaning shall be in accordance with equipment manufacturer's recommendations.
- E. Refer to appropriate Sections for cleaning of other equipment and systems for normal operation.

1.16 EQUIPMENT SELECTION

- A. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- B. All electrical equipment and wiring shall bear the Underwriters Laboratories, Inc. label where UL label items are available, and shall comply with NEC (NFPA-70) and NFPA requirements.
- C. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specification, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturers listed.
 2. Where the words "or approved equal" appear after a manufacturer's name, specific written approval must be obtained from the Engineer during the bidding period in

sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.

3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval during shop drawing submittal.
- D. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- E. Before bidding equipment, and again in the preparation of shop drawings, the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated accessories. Also verify that adequate space is available for servicing of the equipment and that required NEC (and other applicable Code's) clearances are met. The Contractor and his supplier shall also verify compatibility of equipment specified with available system/service voltages, etc.
- F. If extensive changes in conduit, equipment layout or electrical wiring and equipment are brought about by the use of equipment or existing site conditions which are not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.17 SHOP DRAWINGS

- A. One set of shop drawings, in electronic format (pdf), with descriptive information shall be assembled by each Contractor of equipment and materials furnished in his contract, and submitted to the Architect and/or Engineer for review as stated in Division 01. These shall be submitted as soon as practicable and before special equipment is manufactured and before installation.
- B. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.
- C. The review of shop drawings by the Architect or Engineer shall not relieve the Electrical Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- D. Shop drawings of the following electrical equipment and materials shall be submitted:
 1. Firestopping.
 2. Wireway.
 3. Cable trays.
 4. Miscellaneous cabinets.
 5. Plenum cable.
 6. Wiring devices and coverplates.
 7. Service/Distribution switchboard.
 8. Dry type transformer – secondary.

9. Panelboards and associated distribution equipment.
10. Fuses.
11. Lighting Controls including layout plans of Occupancy Sensors.
12. Low voltage switching/lighting control system
13. Lighting fixtures.
14. Lighting standards.
15. Automatic transfer switches.
16. Emergency generator and accessories.
17. Lightning protection system.
18. Fire alarm system with schematic and point to point wiring diagrams.

1.18 TESTING

- A. As each wiring system is completed, it shall be tested for continuity and freedom from grounds.
- B. As each electrically operated system is energized, it shall be tested for function.
- C. The Contractor shall perform megger and resistance tests and special tests on any circuits or equipment when an authorized inspection agency suspects the system's integrity or when requested by the Architect or Engineer.
- D. All signaling and communications systems shall be inspected and tested by a qualified representative of the manufacturer or equipment vendor. Submit four (4) copies of reports indicating results.
- E. Tests shall be witnessed by field representatives of the Architect or Engineer or shall be monitored by a recorder when appropriate. Furnish a written record of each system test indicating date, system, test conditions, duration and results of tests.
- F. Instruments required for tests shall be furnished by the Contractor.

1.19 FINAL INSPECTION AND PUNCH LIST

- A. As the time of work completion approached, the Contractor shall survey and inspect his work and develop his own punch list to confirm it is complete and finished. He shall then notify the Architect and request that a final inspection be made. It shall not be considered the Architect's or Engineer's obligation to perform a final inspection until the Contractor has inspected the work and so states at the time of the request for the final inspection.
- B. Requests to the Architect, Engineer or Owner for final inspection may be accompanied by a limited list of known deficiencies in completion, with appropriate explanation and schedule for completing these; this is in the interest of expediting acceptance for beneficial occupancy.
- C. The Architect and/or Engineer will inspect the work and prepare a punch list of items requiring correction, completion or verification. Corrective action shall be taken by the Contractor to the satisfaction of Architect and Engineer within 30 days of receipt of the Architect/Engineer's punch list.

1.20 OPERATING AND MAINTENANCE MANUALS

- A. Electronic (pdf) copies each of operating and maintenance manuals shall be assembled for the Electrical work by the Contractor.
- B. All shop drawings and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. In addition, the Contractor shall prepare a chart listing all items of equipment which are furnished under his contract and indicating the nature of maintenance required, the recommended frequency of checking these points and the type of replacement material required. Major items of equipment shall consist of not less than the following:
 - 1. Distribution switchgear.
 - 2. Emergency generator and load transfer equipment.
 - 3. Fire Alarm System.
 - 4. Specialty equipment.
- C. Standard NEMA publications on the operation and care of equipment may be furnished in lieu of manufacturer's data where the manufacturer's instruction is not available.
- D. These shall be assembled into three-ring loose leaf binders or other appropriate binding. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to the Architect or Engineer for review. Upon approval, manuals shall be turned over to the Owner.

1.21 RECORD DRAWINGS

- A. The Electrical Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawings shall be turned over to the Architect. This shall apply particularly to underground and concealed work, and to other systems where the installation varies to a degree which would justify recording the change.

1.22 WARRANTIES

- A. Refer to Section 017700 Closeout Procedures.
- B. This Contractor shall warrant all workmanship, equipment and material entering into this contract for a period of one (1) year minimum from date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect. Any materials or equipment proving to be defective during this warranty period shall be made good by this Contractor without expense to the Owner.
- C. This provision is intended specifically to cover deficiencies in contract completion or performance which are not immediately discovered after systems and placed in operation. These items include, but are not limited to, motor controller malfunction, heater element changes required for motor controller, fuse replacement where fuses blow due to abnormal shorts,

adjustments and/or replacement of malfunctioning equipment and adjusting special equipment and communication systems to obtain optimum performance.

- D. This provision shall not be construed to include maintenance items such as making normally anticipated adjustments or correcting adjustment errors on the part of the Owner's personnel.
- E. Provisions of this warranty shall be considered supplementary to warranty provisions under General Conditions.
- F. Extended warranties shall be provided where indicated in the equipment specification Sections.

1.23 OPERATION AND ADJUSTMENT OF EQUIPMENT

- A. As each system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing and adjusting voltages and currents and adjusting all operating equipment.
- B. Caution: Verify that all bearings of equipment furnished are lubricated, all motors are operating in the right direction, and correct overload heater elements are provided on all motors. Do not depend wholly on the other trades judgment in these matters. Follow specific instructions in regard to lubrication of equipment furnished under this Contract.

1.24 OPERATING DEMONSTRATION AND INSTRUCTIONS

- A. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.
- B. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- C. A minimum of 8 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:
 - 1. Show locations of items of equipment and their purpose.
 - 2. Review binder containing instructions and equipment and systems data.
 - 3. Coordinate written and verbal instructions so that personnel understand each.
 - 4. Separate instructions shall be given by manufacturer's representatives for the various special and communications systems.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION – NOT APPLICABLE

END OF SECTION 26 0001

SECTION 26 0002 – ELECTRICAL WORK IN EXISTING BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the following:

1. General Requirements for Renovation Work
2. Inspection of Existing Building
3. Asbestos Material
4. Work Hours
5. Tobacco Products
6. Barriers and Signage
7. Storage of Tools and Materials
8. Protection of Existing Building and Equipment
9. Confined Spaces
10. Noise, Fumes and Dust Control
11. Removals Disposal and Reuse
12. Continuity of Systems
13. Cutting and Patching
14. Cleaning

1.2 GENERAL REQUIREMENTS FOR RENOVATION WORK

- A. Refer to Article 1 Specification requirements and notes on the drawings where provided for requirements related to renovation work.
- B. Meet with the Owner and Architect before demolition or construction begins to establish procedures for work effort in the existing building. Provide names and phone numbers and establish emergency contact information where work is performed. Provide security information requested by the Owner for all personnel who will be working on site. Educate all construction personnel in regard to the project requirements and procedures.
- C. Coordinate effort with other contractors involved in the renovation project to minimize the disruption, phasing of work, share cleaning responsibilities, etc.

1.3 INSPECTION OF EXISTING BUILDING

- A. Each bidder shall inspect the project site and the existing building in the early time frame of the bidding period. Conditions shall be compared with information shown on the drawings. Report to the Architect any significant discrepancies which may be discovered in a timely fashion so

that direction may be provided in an addendum. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

1.4 ASBESTOS MATERIAL

- A. Abatement, removal or encapsulation of existing materials containing asbestos is not included in the Contract. Necessary work of this nature will be arranged by the Owner to be done outside of this construction and remodeling project by a company regularly engaged in asbestos abatement. Such work will be scheduled and performed in advance of work in the construction and remodeling project.

- B. If, in the performance of the mechanical work, materials are observed which are suspected to contain asbestos, the Contractor shall immediately inform the Architect who in turn will notify the Owner. Work that would expose workers to the inhalation of asbestos particles shall be terminated. Work may be resumed only after a determination has been made and unsafe materials have been removed or encapsulated and the area declared safe.

1.5 WORK HOURS

- A. Work hours for construction shall be as defined in Section 01150- Project Phasing or other specification sections or drawing notes.

- B. Where allowed, contractors may work normal hours except after hours is required for operations that are noisy, generate obnoxious fumes or dust, require shut down of ventilation systems, etc. The Owner reserves the right to stop normal hour work where the Owner deems the effort to be disruptive to their ongoing operations.

- C. Any work that creates hazards in or requires closure of corridors, exit pathways or stairwells work in corridors must be performed after hours when the building is not occupied.

- D. All occupied areas, corridors exit pathways and stairwells must be left clean, lighted (including emergency egress and exit signage) usable and safe at the end of each work shift.

- E. Access to the work area shall be coordinated with the Owner; follow all security protocols for parking, sign in, key control, etc. established by the Owner.

1.6 TOBACCO PRODUCTS

- A. Smoking or chewing tobacco products are expressly prohibited to be used within the building and on the premises except where specifically permitted by the Owner or in construction company trailers or vehicles where permitted by the construction company.

PART 2 - PRODUCTS- NOT APPLICABLE

PART 3 - EXECUTION

3.1 BARRIERS AND SIGNAGE

- A. Barriers and signage shall be provided as appropriate to identify work areas and to prevent unauthorized entry by non construction personnel. Refer to appropriate Division 1 specification requirements and notes on the drawings where provided.
- B. All barriers and signs should be high visibility type and be maintained at all times.

3.2 STORAGE OF TOOLS AND MATERIALS

- A. Store all site material and tools in the active job site area, specific storage areas are not provided except where otherwise noted for material and tools. The contractor is responsible for security.
- B. Storage is specifically prohibited in means of egress paths and stairwells.

3.3 PROTECTION OF EXISTING BUILDING AND EQUIPMENT

- A. The Owners' property and the property of other contractors shall be respected at all times. Provide drop clothes, visqueen or other suitable barriers where dust and debris is generated. Tape ends of barriers for sealing purposes.
- B. Provide 55 gallon drums or smaller buckets as appropriate and use funnels where draining liquid systems.
- C. Provide plywood sheets for protection of walls, floors or Owner equipment or systems that are remaining in place near demolition or new installation work where there is possible damage from heavy material or equipment.

3.4 CONFINED SPACES

- A. Notify the Owner when performing work in confined spaces. Provide a written procedure for approval and obtain approval from the Owner when so requested.
- B. All work in confined spaces shall be done in accordance with OSHA regulations.

3.5 NOISE FUME AND DUST CONTROL

- A. Provide barriers and ventilation as required to limit the effect from construction generated noise

fume and dust control on spaces that continue to be occupied by the Owner. Refer to protection of building and equipment paragraph above. In addition to the basic protection, provide additional visqueen barriers to limit airborne migration of dust and fumes. Provide supplemental portable fans to exhaust air to the outside of the building where appropriate. Use of the Owners' ventilation systems to induce positive or negative pressure is prohibited unless authorized by the Owner. Shut off ventilation systems serving the area where use of these systems can induce fumes or dust into return or exhaust ducts. Where systems need to remain operational for occupied areas, arrange to temporarily shutoff portions of the system in the work area. Coordinate all efforts requiring modification or shutdown of ventilation systems with the Owner. Contractor shut down of these systems is prohibited without Owner permission.

- B. Arrange with the Owner when required to shutoff fire alarm or smoke detectors to perform work. With the Owners' prior approval. Cover smoke detectors where needed to prevent false alarms due to generated dust or fumes. Minimize outages and coordinate efforts to limit the effect due to false alarms.
- C. Where significant dust or fume generating work, welding or cutting operations are required for removal or new work, provide fume removal equipment with telescoping arms to locally capture the fumes. Fume exhaust shall be directed outside or adequately filtered and recirculated.
- D. Areas shall be thoroughly ventilated after completion of the work on a daily basis to remove residual odors and fumes before occupancy occurs the next day.
- E. Provide vacuum cleaners and other equipment to clean and restore conditions.

3.6 REMOVALS DISPOSAL AND REUSE

- A. Refer to the drawings for the scope of remodeling in the existing building.
- B. Cooperate with the General Contractor regarding all removal and remodeling work. Each Contractor shall remove existing work which is associated with his trade and which will be superfluous when the new work is installed and made operational.
- C. Extraneous conduit and wiring which is or becomes accessible shall be removed back to source or last active device. Conduit and wiring that is and remains inaccessible shall be abandoned. Upon completion of the work no abandoned boxes, conduits or wiring shall extend thru finished floors, walls or ceilings.
- D. When it is necessary to reroute a section of active circuitry the rerouted section shall be installed before removing the existing in order to minimize system down time.
- E. Where existing equipment, boxes, conduits etc. are removed and holes are left in existing walls, finished ceilings, floors etc. these holes shall be patched using materials to match the existing construction to restore and maintain the integrity of the existing partition.
- F. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where

directed on the premises all removed material and equipment so designated by the Owner. All material and equipment which the Owner does not wish to retain shall become the property of the Contractor responsible for removal and shall be removed from the premises and properly disposed.

- G. Disposal of materials regulated by EPA, including lamps and ballasts shall be done in strict accordance with latest requirements. Provide documentation to the Owner that disposal was properly executed.
- H. Remove, store and reinstall lay-in ceiling tile and grid as needed to perform work in areas where such removal and re-installation is not to be done by the General Contractor. Damaged tile and/or grid shall be replaced with new matching tile and/or grid.
- I. In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with Owner. Protect the Owner's property by providing dust covers and temporary plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.
- J. Refinish any surface disturbed under this work to match existing, except where refinishing of that surface is included under the General Contract.

3.7 CONTINUITY OF SYSTEMS

- A. Work shall be so planned and executed as to provide reasonably continuous services of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch-over, the Owner shall be notified in advance and outages scheduled at the Owner's reasonable convenience.
- B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline must include tentative dates, times of day for disruption, downtime and restoration services. Submit the outline sufficiently in advance of the proposed work to allow the Architect to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.
- C. Shutdown of system and work undertaken during shutdowns shall be bid as being done during normal working hours. If the Owner should require such work be performed outside of normal working hours, reimbursement shall be made for premium time expenses only.

3.8 CUTTING AND PATCHING

- A. Refer to Division 1 – General Requirements for information regarding cutting and patching.
- B. Plan the work well ahead of the general construction. Where conduits are to pass thru new walls, partitions, floors, roof or ceilings, place sleeves in these elements or arrange with the General Contractor to provide openings where sleeves are not practical. Where sleeves or openings have not been installed, cut holes and patch as required for the installation of this

work, or pay other trades for doing this work when so directed by the Architect. Any damage caused to the building shall be repaired or rectified.

- C. Where conduits are to pass thru, above or behind existing walls, partitions, floors, roof or ceiling, cutting, patching and refinishing of same shall be included in this contract. Core drilling and saw cutting shall be utilized.
- D. All material, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Architect. Wall, floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.
- E. Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry wall where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck.

3.9 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain.

END OF SECTION 26 0002

SECTION 26 0004 – FIRESTOPPING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of

construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Firestopping materials shall be manufactured and/or supplied by:

1. Hilti, Inc.
2. Johns Manville.
3. Nelson Firestop Products.
4. Specified Technologies Inc.
5. 3M; Fire Protection Products Division.
6. Tremco; Sealant/Weatherproofing Division.

2.2 FIRESTOPPING

A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every conduit or opening at penetration of all fire resistance rated walls and horizontal assemblies.
- D. Provide rigid supports for conduit on both sides of the fire resistance rated wall or assembly where required as part of the fire stop assembly.
- E. Coordinate opening size and additional framing requirement with the General Contractor for each opening to meet the firestop installation requirements.
- F. Refer to 26 0533 Raceway and Boxes for Electrical Systems for sleeve requirements and treatment of penetrations not requiring firestopping.

END OF SECTION 26 0004

SECTION 26 0005 – EXCAVATION, BACKFILL AND SURFACE RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Excavating and backfilling for all in-grade underfloor conduit, exterior ducts, conductors, conduit, lighting standard bases, manholes, handholes, pullboxes, utility trenches and any incidental work included in the Electrical Contract.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over conduit or duct in a trench, including haunches to support sides of conduit.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Course placed over the excavated sub-grade in a trench before laying manhole, pullbox or conduit.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

E. Fill: Soil materials used to raise existing grades.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below topsoil materials.

H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1.4 GENERAL

- A. Excavate for all in-grade underfloor conduit, exterior ducts, conductors, conduit, lighting standard bases, manholes, handholes, pullboxes, utility trenches and any incidental work included in the Electrical Contract.. Backfill to finish grade or to levels consistent with the General Contractor's and Site Contractor's activities. Cut existing street, drive and parking lot paving, walks, curbs and other permanent hard surfaces which are to be encountered. Repair or restore exterior surfaces to original condition where such are not affected by Division 2 – Site Work. Cut existing floor slabs and replace slabs in conformance to 26 002 Basic Electrical Materials and Methods. All work shall comply with requirements set forth in Division 2.
- B. Excavation and trench wall supporting, cribbing, sloping and stepping of excavations required for safety shall be done in accordance with OSHA and local requirements. Pumping of water from excavations and trenches which may be required during construction shall be included in this contract.
- C. Contact the Ohio Utilities Protection Service (1-800-362-2764) well in advance of the start of any excavation to determine if any of the utility companies or departments have underground utilities in or near the project area.
- D. Contact local water and sewer departments, gas company, electric company, telephone company, etc., regarding the possibility of encountering existing utilities. The integrity of all existing utilities shall be respected.
- E. Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced by the Contractor to the full satisfaction of the utility owner.

PART 2 - PRODUCTS

- 2.1 Refer to Division 31 Earthwork for bedding and backfill materials

PART 3 - EXECUTION

3.1 EXCAVATION FOR UTILITY TRENCHES

- A. Interior and exterior trenches shall be over-excavated and the conduits, ducts or conductors shall be laid on 6" minimum depth sand bed.
- B. Backfilling of excavations and trenches inside the building and outside under paved or other hard surfaced areas, shall be with graded pea gravel, graded coarse sand or crushed limestone,

3/4" maximum size, to prevent undue settlement. Backfill material for plastic piping shall be pea gravel or sand. Other excavations and trenches shall be backfilled with similar materials up to 18" above the top of the conduit or conductor. The remainder shall be with similar materials or with excavated material having no large clods, stones or rocks.

- C. Maintain in place adequate barricades, guards, planking, plating signage, warning lights, etc., at and around excavations.
- D. Backfill shall be mechanically compacted in layers not over 6" deep. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of as directed by the General Contractor. Refer to Division 31 Earthwork for compaction requirements.
- E. Excavation, backfill, surface repair and traffic control within the public right-of-way shall be in accordance with governing agency rules and regulations. Any fee for activity in the roadways shall be included in this contract so that no additional cost will accrue to the Owner.
- F. All exterior underground direct buried conductor, conduit and concrete encased ducts shall be protected against future excavation damage by placing a plastic tape warning marker in each trench during backfill. Tape shall be 6" wide with black letters identifying the type of service. Tape shall be equal to that manufactured by Seton. Install tape full length of the trench approximately 18' above and on the centerline of the conductor, conduit or duct.
- G. In addition to a warning tape, concrete encased ducts shall have a concentrated red dye poured on top of the concrete before fully cured.

END OF SECTION 26 0005

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SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and XHHW.
- C. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC and metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
 2. Hubbell Power Systems, Inc.
 3. O-Z/Gedney; EGS Electrical Group LLC.
 4. 3M; Electrical Products Division.
 5. Tyco Electronics Corp.
- C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Stranded for No. 12 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- E. Branch Circuits Concealed in Existing Walls and Fixture Whips: Armored Cable, Type AC, Metal-Clad Cable, Type MC, cable shall have separate internal ground wire.
- F. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- G. Class 2 Control Circuits: Power-limited cable, in raceway.
- H. Use type THHN or XHHW (90 degrees C. rated) for connecting fluorescent fixtures and for running thru fixture housings.
- I. Use conductors such as type FEP with high temperature insulation as identified in the NEC for connections to resistance heating elements or in other areas subject to temperature exceeding the rating of THWN, XHHW or THHN.
- J. In addition to the conduit system, a separate grounding conductor shall be installed with all feeders and branch circuitry.

- K. Equipment grounding conductors shall be green, or completely taped green, at all accessible points.
- L. Wire size ampacity shall equal or exceed its overload protective device. Where sizes shown on the drawings are greater than the apparent ampacity requirements, the size shown shall prevail to compensate for voltage drop. In no instance shall conductors be installed that are less than required by the N.E.C. Minimum conductor size shall be No. 12 AWG except No. 14 AWG may be used for control wiring or where otherwise specifically indicated.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Provide a separate neutral for each branch circuit serving receptacles (no shared neutral).
- 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. Conduit systems shall be clean and clear before pulling wires. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway. Pulling of branch circuit conductors shall be performed by manual means without the use of levers or heavy pulling devices that may compromise the conductor's or insulation integrity.
- E. A maximum of 8 conductors shall be installed in a branch circuit conduit unless specifically noted otherwise on the drawings. Equipment ground conductors are not counted when determining maximum fill.
- F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- G. Wiring in vertical raceways shall be supported with strain relief devices; Kellems grips or approved equal.
- H. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."
- I. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- K. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- L. Underground splices (including splices in exterior pullboxes and manholes) shall be made using sealing kits or wire nuts U.L. listed and approved for the application.

- M. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack. Refer to additional notes on plans for branch circuitry installation requirements.

3.4 TESTING

- A. As each wiring system is completed, it shall be tested for continuity and freedom from grounds.
- B. As each electrically operated system is energized, it shall be tested for function.
- C. On all electric services including change-outs, backfeeds, etc. the Contractor shall verify phase rotation and voltage readings to assure the final installation is proper. Submit to the Engineer in writing a record of voltage readings and current readings taken at no-load and fully loaded conditions.
- D. The Contractor shall perform megger and resistance tests and special tests on any circuits or equipment when an authorized inspection agency suspects the system's integrity or when requested by the Engineer.
- E. Tests shall be witnessed by field representatives of the Engineer or shall be monitored by a recorder. Furnish a written record of each system test indicating date, system, test conditions, duration and results of tests. Copies of all test reports shall be included in the O&M manuals.
- F. Instruments required for tests shall be furnished by the Contractor.

END OF SECTION 26 0519

SECTION 26 0523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. UTP cabling.
 - 2. RS-232 cabling.
 - 3. RS-485 cabling.
 - 4. Low-voltage control cabling.
 - 5. Control-circuit conductors.
 - 6. Identification products.

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 and signaling power-limited circuits.
- B. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.
- C. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of an NRTL.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: **25** or less.
 - 2. Smoke-Developed Index: **50** or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
- B. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Support of Open Cabling: NRTL labeled for support of **Category 6** cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." **Flexible metal conduit shall not be used.**
 - 1. Outlet boxes shall be no smaller than 2 inches wide, 4 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

- A. Description: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches. Prime and finish paint to match adjacent walls (if finish painted) or finish paint white or light gray.

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, **provide products by one of the following:**
 - 1. Belden CDT Inc.; Electronics Division.
 - 2. Berk-Tek; a Nexans company.
 - 3. CommScope, Inc.
 - 4. Draka USA.
 - 5. Genesis Cable Products; Honeywell International, Inc.
 - 6. KRONE Incorporated.
 - 7. Mohawk; a division of Belden CDT.
 - 8. Nordex/CDT; a subsidiary of Cable Design Technologies.
 - 9. Superior Essex Inc.
 - 10. SYSTIMAX Solutions; a CommScope, Inc. brand.
 - 11. 3M.
 - 12. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. Description: 100-ohm, four-pair UTP.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, **Category 5e**.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or Type CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or Type MPG.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, **provide products by one of the following**:
 1. American Technology Systems Industries, Inc.
 2. Dynacom Corporation.
 3. Hubbell Premise Wiring.
 4. KRONE Incorporated.
 5. Leviton Voice & Data Division.
 6. Molex Premise Networks; a division of Molex, Inc.
 7. Nordex/CDT; a subsidiary of Cable Design Technologies.
 8. Panduit Corp.
 9. Siemon Co. (The).
 10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

2.5 RS-232 CABLE

- A. Standard Cable: NFPA 70, Type CM.
 1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 2. Polypropylene insulation.
 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 4. PVC jacket.
 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 6. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
 1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 2. Plastic insulation.

3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.6 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.7 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.8 CONTROL-CIRCUIT CONDUCTORS

- ### A. Class 1 Control Circuits: Stranded copper, **Type THHN-THWN**, in raceway, complying with **UL 83**.

- B. Class 2 Control Circuits: Stranded copper, **Type THHN-THWN, in raceway or power-limited cable, concealed in building finishes**, complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.9 IDENTIFICATION PRODUCTS

- 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. Brady Corporation.
 - 2. HellermannTyton.
 - 3. Kroy LLC.
 - 4. Panduit Corp.
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

- A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 4. Cables may not be spliced.
- C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Install 110-style IDC termination hardware unless otherwise indicated.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than **60 inches** apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

3.3 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, **No 14** AWG.
2. Class 2 low-energy, remote-control, and signal circuits, **No. 16** AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits, **No 12** AWG.

3.4 FIRESTOPPING

- A. Comply with requirements in Section 26 0004 "Firestopping for Electrical Systems."

3.5 GROUNDING

- A. For data communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Visually inspect UTP cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 26 0523

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SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM 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 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 wide and 1/16 inch thick.

2.2 GROUNDING RODS

- A. Grounding Rods shall be copper clad, molten welded copper to steel; unless otherwise designated, 3/4" diameter X 10 ft. long.

2.3 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Clamps and continuity devices shall be non-ferrous material, UL approved. Connections to ground rods and all underground connections shall be made with welded connections (“Thermoweld” or “Cadweld”).

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. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. 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. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels.
- B. 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.
- C. Wiring devices shall be connected with grounding jumper from ground pole on device to grounding screw (or grounding pigtail) in the outlet box.
- D. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
- C. Main service neutral shall be grounded to the street side of the building water service. A bonding jumper shall be installed around the water meter. In addition to using the water service as a grounding electrode, effectively grounded building steel, driven ground rods outside or buried electrode shall be provided and connected. Bond to interior metallic water, gas and all other metallic lines.
- D. The complete metal conduit system shall be used for the equipment grounding system. Conduit systems and associated fittings and terminations shall be made mechanically tight to provide a continuous electrical path to ground and shall be safely grounded at all equipment by bonding all metallic conduit to the equipment enclosures with locknuts cutting thru paint of enclosures. Bond all conduits entering service entrance switchboard with a ground wire connecting the grounding bushings to the equipment ground bar. Conductors shall be sized per NEC Tables 250-66 and 250-122. Bond all communications conduit systems to ground.
- E. In addition to using the conduit system for grounding, a complete auxiliary green wire equipment grounding system shall be installed, continuous from main ground, thru distribution

and branch circuit panelboards and paralleling all feeders and branch circuit wiring. Grounding conductor sizes shall comply with NEC Table 250-122, minimum size shall be #12 copper except #14 on control circuits. This shall apply to all circuits rated 100 volts or more above ground potential.

- F. Ground neutral of all transformers for separately derived systems.
- G. Motor frames shall be bonded to the equipment grounding system by an independent green wire, sized as shown.
- H. Cord connected appliance frames shall be grounded to the equipment grounding system thru a green wire in the cord.
- I. A green grounding conductor shall be installed in each non-metallic conduit and all flexible conduits, including exterior underground conduits.
- J. System neutral connections shall be insulated from metal enclosures except at the neutral of the service entrance equipment and on the neutral of a separately derived system. Connections to the main service enclosure shall be by means of bonding jumpers.
- K. The building neutral shall be identified throughout with white conductors for 280/120 volt systems and grey conductors for 480/277 volt systems. Where there are neutral conductors from a separately derived system (such as 120/208 volt, 3 phase, 4 wire where the main building service is 277/480 volt, 3 phase, 4 wire) the neutrals of the two systems shall be separately identifiable per NEC Article 200.
- L. A minimum #6 ground wire shall be run from each telephone backboard/data rack back to the main building ground. Or where indicated on the drawings or in the specifications, a separate communications grounding system shall be provided and bonded to the electrical grounding system at the main ground bar.
- M. Bond the generator neutral to the generator equipment grounding conductor. Bond the generator frame to the equipment grounding conductor. Provide signs at the grounding locations per NEC Article 701.
- N. Where metal covers on pull boxes and junction boxes are used, they shall comply with the grounding and bonding requirements of NEC Article 250.
- O. Connections to driven ground rods or other such electrodes shall be a minimum of 3 feet from the building foundation wall or beyond the roof drip line, whichever is greater.
- P. The ground rods of the electrical grounding system shall not be used as the electrodes (ground rods) of the lightning protection system (where specified) and vice versa. However, the lightning protection system (where specified) shall be bonded to the electrical grounding system at one point per NEC.

END OF SECTION 26 0526

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. Thomas & Betts Corporation.
 - e. Unistrut; Tyco International, Ltd.
 - f. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.

- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 5. Toggle Bolts: All-steel springhead type.
 - 6. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Utilize supports with swivel type attachments to maintain true vertical support from sloped structure or inclined structural elements (such as beam clamp with swivel option).

- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on blocking attached to substrate by means that meet anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 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.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.4 CONCRETE BASES

- A. Provide dowel rods to connect concrete bases to concrete floors/slabs/substrates. Unless otherwise indicated, install dowel rods on maximum 18-inch centers around the full perimeter of concrete base.
- B. Provide epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor/slab/substrate, unless concrete bases are installed directly on grade. Place and secure anchorage devices. Using setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast galvanized or stainless-steel anchor-bolt inserts into bases.
- D. Indoor bases shall be at least 4" thick and shall have straight and finished sides and a 1"-45 degree chamfer at the top perimeter. Reinforcing steel bars shall be placed in both directions of the bases. Where required for supplemental support, provide lateral support work to adjacent wall(s). Provide concrete bases/housekeeping pads beneath all electrical power and systems distribution equipment that is floor mounted or wall mounted within 4" of the floor.
- E. Outdoor bases shall be at least 6" thick and shall have straight and finished sides and a 1"-45 degree chamfer at the top perimeter. Perimeter of pads shall extend down below the frostline. Reinforcing steel bars shall be placed in both directions of the bases and a mesh overlay shall be provided. Where required for supplemental support, provide lateral support work to adjacent wall(s). Provide concrete bases/housekeeping pads beneath all electrical power and systems distribution equipment that is slab or grade mounted or mounted within 6" of slab or grade.
- F. Unless indicated otherwise in specifications or on drawings, use minimum 3000-psi, 28-day compressive-strength concrete. Size and provide concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.
- G. Forms: As required for equipment pads or other special applications in field, provide forms made of steel, wood, or other suitable material of size and strength to resist movement during concrete placement, and to retain horizontal and vertical alignment until removal. Use straight forms, free distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends. Do not remove forms for 24 hours after concrete has been placed. Set forms to required grades and lines, rigidly braced and secured. Provide sufficient quantity of forms to allow continuous progress of work, and so that forms can remain in place at least 24 hours after concrete placement. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage. Form areas that involve termination of spare conduits below grade, or that involve continuation of conduits by others, accordingly to accommodate easy future access to the ends of conduits for future extensions.
- H. Reinforcement: Cut bars true to length with ends square and free of burrs. Provide metal expansion caps for one end of each dowel bar in expansion joints. Design caps with one end closed and minimum length of 3" to allow bars movement of not less than 1", unless otherwise indicated. Provide these for joining applications where continuous pouring cannot be accomplished.

- I. Concrete Placement: Remove loose material from subbase surface immediately before placing concrete. Check subbase and forms for line and grade before placing concrete. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Place concrete using methods that prevent segregation of mix. Use splash boards to divert the flow of concrete away from the trench sides, and to avoid dislodging soil and stones. Coordinate with Owner's Representative at least 72 hours prior to placing concrete. Line up concrete trucks as required to achieve one continuous pour where applicable. Do not backfill until a minimum of 48 hours have passed.
- J. Concrete Finishing: Smooth surface by screeding after striking-off and consolidating concrete. Provide Class A finishing. Broom finish concrete pads, and aprons around pullboxes and structures. Protect concrete from damage until acceptance of work. Exclude traffic over affected areas for at least 14 days after placement.

3.5 PLYWOOD EQUIPMENT BOARDS

- A. Plywood Equipment Boards: Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent. Provide plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than $\frac{3}{4}$ inches deep. Provide marine grade plywood where subject to moisture conditions. Provide Simpson Strong Tie (or equal) expansion screw anchors.
- B. Unless otherwise noted, boards shall be painted with two coats of good grade weatherproof flat gray non-conductive fire-retardant paint on all sides and edges (prior to mounting) and plumbed in a true vertical position. Provide nominal $\frac{1}{2}$ " rustproof spacers between back of plywood and wall. Cut, fit, and place plywood equipment boards accurately in location, alignment, and elevations to support and anchor electrical materials and equipment. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members. Attach to substrates as required to support applied loads. Maintain at least 4 inches from bottom of plywood equipment boards and the finished floor surface.
- C. Unless directed otherwise in field, plywood equipment boards shall be 8 feet high by $\frac{3}{4}$ inches deep by length shown on drawings (as dimensioned or as scaled) or length as required to accommodate equipment if not indicated on drawings. Unless directed otherwise in field, provide plywood equipment boards for all indoor surface mounted panelboards and systems "head-end" equipment for all applications where located in mechanical or electrical rooms/areas and only where specifically shown on drawings for all other applications.

END OF SECTION 26 0529

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SECTION 26 0533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: Steel only; set-screw or compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. ENT: NEMA TC 13.
- B. RNC: NEMA TC 2, unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

2.3 CABLE TRAY (Wire Basket Type)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper B-Line, Inc.
 - 2. Mono Systems.
 - 3. MP Husky.
 - 4. Thomas & Betts.
 - 5. Cablofil.
 - 6. Cope.
 - 7. Wiremaid.
- B. Description: Basket tray shall be steel wire structure, welded at all wire intersections and zinc plated after construction. 12" wide with 4" load depth (unless size is indicated otherwise on the plans), supported at 12 ft. intervals at a minimum or as required by manufacturer to meet load rating and as field conditions and structure dictate.
- C. General: Except as otherwise indicated, provide metal basket trays, of types, classes and sizes indicated, with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
- D. All field formed bends or transitions shall be either a UL listed and approved assembly or where the tray is modified in the field, shall be Field Evaluated and approved by UL.
- E. Splice connectors shall be the bolted type. The resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohms. Splice connector construction shall be such that a splice may be loaded anywhere within the support span without diminishing rated load capacity (and grounding capacity) of the basket tray. Splice plates shall be furnished with straight sections and fittings or with clamp fittings to enable field cut and formed bends as recommended by the manufacturer.
- F. Cable Tray Supports: Shall be placed so that the support spans do not exceed maximum span as recommended by the manufacturer. Supports shall be constructed from 12-gauge steel formed shape channel members with necessary hardware such as trapeze support kits. Basket trays installed adjacent to walls shall be supported on wall mounted brackets.

- G. Trapeze hangers shall be supported by 3/8" (minimum) diameter rods or cable suspension system listed and approved for use by the tray manufacturer. Provide PVC sheath on threaded rod section passing thru basket when center-hung type supports are utilized to protect cabling.

2.4 SURFACE RACEWAYS

- A. Surface Metal Raceways: Brushed Aluminum with snap-on covers.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Mono Systems.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Hubbell Wiring Systems.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- F. Cabinets:
 - 1. NEMA 250, Type 1, 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.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit.

2. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
 - a. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT except FMC may be utilized in existing walls.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Damp or Wet Locations: Rigid steel conduit.
7. Raceways for Optical Fiber or Communications Cable: EMT.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch 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.
2. EMT: Use all steel, compression type or all steel setscrew type, concrete tight.
3. Flexible conduit: Use malleable iron, "squeeze" type, non-insulated. (For lighting fixture whips only: Use all steel or die-cast screw-in connector).
4. Liquid-tight conduit: steel or malleable iron.

3.2 CABLE OR BASKET TRAY APPLICATION

- A. Locate tray such that a minimum 12" clearance is maintained above and to one side of tray to accommodate installation of cabling. Carefully coordinate installation with other trades to maintain this clearance.
- B. For wire basket type tray, follow the manufacturer's installation details for cutting methods and locations for field formed connections, bends and offsets.

3.3 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter. Generally run conduit and conductors as high as practicable against underside of floor slab in concrete construction or immediately below the **top chord** of bar joist construction unless otherwise shown or noted.

This high level zone shall be used for running electrical raceways and shall be grouped or racked together wherever feasible. Runs at bottom chord level or ceiling grid level are not acceptable.

- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation. Plan raceway routing to minimize the number of offsets and junction boxes.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. All conduit shall parallel building lines.
- G. Conduit shall be run overhead and shall not be run below concrete slabs unless specifically indicated on the drawings and in the legend on the drawings.
- H. Conduit crossing building expansion joints shall have expansion provisions with grounding continuity, use special expansion fittings listed for the application. Refer to the Architectural and Structural floor plans and details for locations of expansion joints.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- K. Raceways for Data, Audio Visual and Communications Cable: Install as follows:
 - 1. 1-Inch Trade Size and Smaller: Install raceways in maximum lengths of 75 feet.
 - 2. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
 - 3. Raceway shall be installed continuously from outlet box to above edge of nearest cable tray above accessible ceiling.
 - 4. Bond raceway to cable tray with approved grounding bushing, bonding jumper and necessary fittings.
- L. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in all locations except MC may be used for lighting fixture whips.

- M. 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.
- N. Do not install wall-mounted boxes back-to-back in opposite sides of wall; in stud walls, boxes shall be on opposite side of studs.
- O. Provide access to all junction and pull boxes.
- P. Set metal floor boxes level and flush with finished floor surface. Provide trim ring compatible with finish floor system.
- Q. Pull mandrel or large swab thru conduit to assure freedom from debris before pulling wires. Use listed pulling lubricants where necessary.
- R. Provide four (4) 1 inch diameter spare conduits for each flush mounted branch circuit panelboard; extend from top of panelboard to above an accessible ceiling for future use.
- S. Contractor shall record carefully on a set of "as-built" prints, the exact location of all feeder conduits (100 amps and larger).
- T. Unless noted otherwise on the drawings, a maximum of 8 conductors shall be installed in a branch circuit conduit. This maximum is a count of all phase and neutral conductors only.

3.4 INSTALLATION OF EXPOSED CONDUIT OUTDOORS

- A. Only install conduit exposed outdoors when it is impossible to do otherwise, or only if specifically indicated for such installation case-by-case elsewhere in documents. Installation convenience, financial considerations, lack of coordination with other trades and similar rationale are not sufficient reasons for conduit sizes per NFPA 70 (National Electrical Code, NEC). Provide expansion fittings, which are Listed and labeled for the respective applications, at all building expansion joints and at maximum distances of 100 feet. Paint all such conduits with at least two coats of UV-resistant weatherproof paint. Provide colors to match respective surrounding surfaces; submit colors to Design Professional for review in advance of procuring paint.

END OF SECTION 26 0533

SECTION 26 0537 – J-HOOK PATHWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 GENERAL

- A. Conduit/Raceway/Pathway: “Conduit”, “raceway”, “pathway” and similar terms shall be taken to mean “conduit” unless specifically indicated otherwise in project manual documents, or unless specifically directed otherwise in field by Owner or Design Professionals. All such terms shall be considered synonymous for the general purposes of installation means and methods.
- B. Provide J-Hook pathway systems only for the following limited applications: Class 2 (“low voltage”) control wiring above accessible finished-ceiling systems.
- C. Coordination Drawing Submittals: Prior to commencing with any related work, submit 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. Routing.
 - 2. Scaled layout and relationships between components and adjacent structural, electrical, and mechanical elements.
 - 3. Vertical and horizontal offsets and transitions.
 - 4. Clearances for access above and to side of pathways.
 - 5. Vertical elevation of pathways above the floor or below bottom of ceiling structure.
 - 6. Structural members in paths of conduit groups with common supports.
 - 7. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 J-HOOK PATHWAYS

- A. Acceptable Manufacturers: Subject to being equivalent and subject to compliance with requirements, provide product by one of the manufacturers listed below, or equivalent NRTL listed and labeled equivalent.
 - 1. Cooper B-Line (basis of design, model numbers as specified further below).
 - 2. Mono-Systems, Inc.
- B. Materials Description:
 - 1. Provide J-Hook system components that are plenum-rated (regardless of whether air plenum ceilings exist on the project). Provide J-Hooks, not Cable Fasteners, and not Bridle Rings. Provide open-top hooks, so cables can be laid into J-Hooks rather than threaded through. Provide tool-less cable retainer clips (do not use cable ties). Provide hooks sized for maximum 40% fill (in cross section) based on outside diameter of cables. Accordingly, provide multiple sets of J-Hooks along any given pathway as applicable.
 - 2. Provide necessary factory hooks, cable retainers, fasteners, attachment kits, etc. as required for complete installations.

2.2 MATERIALS AND FINISHES

- A. Provide steel units with rolled hook edges to prevent damage to cable jackets and insulation.
- B. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.
- C. Cable hooks for corrosive areas shall be stainless steel, AISI Type 304.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide J-Hook support along “free-air” cable pathway routes. Provide J-Hooks at four-foot intervals and at offsets. Route J-Hooks above ceilings through corridors and similar open areas wherever possible to minimize above-ceiling wall penetrations.
- B. Layout and install all electrical work in strict compliance with Chapter 1, Part B, Section 110.26 of the latest adopted edition of NFPA 70. Locations and routing that may be shown on plans are schematic and diagrammatic in nature. Layout all proposed pathway routing, elevations, installation methods, etc. on coordination drawings and coordinate all proposed routing with all affected trades prior to commencing with work. In addition, review the information with Owner and Design Professionals for all areas where pathways will be visible after completion of construction, to ensure a neatly organized installation occurs. Where exposed in finished areas, install in a manner that minimizes detrimental effects on room aesthetics. Install as out of site as reasonably possible.
- C. Keep pathways at least 24 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal runs above liquid and steam piping. Level and square runs, and install at proper elevations and heights. Do not begin installation of cables until J-Hook pathway installations are complete and until installations locations (end to end) are in a weatherproof environment. Install pathways so that they are accessible for cable installation after construction is complete. Install pathways with enough workspace to permit access for installing cables. Strictly adhere to factory load capacities and fill capacity. Provide factory cable retainers, fasteners, attachment kits, and other accessories as required for a complete installation.
- D. Securely anchor (mechanical, not adhesive) J-Hooks directly to structural components of the building. Do not anchor J-Hooks to ductwork, conduit, piping, fixtures, equipment, ceiling supports (rods, wires, T-bars), etc. Comply with requirements in Section 260529 and related sections for hangers and supports. Support using factory-approved methods. Fasten cables on horizontal runs with factory cable clamps, retainers, fasteners, attachment kits or flexible Velcro-secured wraps compliant with NEMA VE 2. Tighten clamps/wraps only enough to secure the cable, without indenting the cable jacket. Use of synthetic or plastic “tie-wraps”, “zip ties”, “wire ties” and similar products are not permitted as a permanent means of anchoring, securing, supporting or otherwise installing any cables, conductors, conduits, raceways, devices equipment or other electrical work. Do not use perforated strap.

- E. Coordinate work prior to rough-in with respective equipment and cable installers, and with Owner's Representative. Carefully coordinate proposed routing, including elevations, with affected installers and entities prior to rough-in. Neatly route paths parallel and perpendicular to building architectural lines, plumb on walls, and at a consistent elevation wherever possible. Install paths in a uniform plane/elevation wherever possible. Keep horizontal and vertical offsets to an absolute minimum. Route paths so that a minimum of 24 inches exists between cables and potential EMI sources such as lighting ballasts, motors, power wiring, dimmer circuits, etc.

- F. Provide a minimum of two (2) 3-inch bushed conduit sleeves where pathway is routed above inaccessible ceilings, and at penetrations of floors, masonry walls, fire rated walls, smoke-tight partitions, smoke-related partitions, and similar elements. Provide smoke and fire stopping at such penetrations as applicable in (see Section 260502). Provide EMT conduit for "drops" from paths to outlets and equipment, with sweep bends, insulated throat fittings and 200-pound pull string.

END OF SECTION 26 0537

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SECTION 26 0543 –UNDERGROUND DUCTS AND RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
2. Handholes and boxes.

1.2 SUBMITTALS

A. Product Data: For accessories for handholes, and boxes.

B. Shop Drawings for Factory-Fabricated Handholes and Boxes: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Cover design.
3. Grounding details.
4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

C. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B. Utilize galvanized rigid steel for 90 degree bends (long sweep type) with proper adapters between PVC duct and galvanized steel.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cantex, Inc.
 2. CertainTeed Corp.; Pipe & Plastics Group.
 3. Heritage Plastics.
 4. Carlon Electrical Products.
 5. Manhattan/CDT; a division of Cable Design Technologies.
 6. Spiraduct/AFC Cable Systems, Inc.
- B. Duct Accessories:
1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, to provide minimum duct spacings while supporting ducts during concreting or backfilling.

2.3 HANDHOLES AND BOXES

- A. Description: Comply with SCTE 77.
1. Color: Gray.
 2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 5. Cover Legend: Molded lettering, As indicated for each service.
 6. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer Handholes and Boxes: Molded of fiberglass-reinforced polymer concrete, with matching covers.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carson Industries LLC.
 - b. Quazite (Hubbell).
 - c. Highline Products, Inc.

PART 3 - EXECUTION

3.1 EARTHWORK AND RESTORATION

- A. Refer to Division 26 Section “Excavation, Backfill and Surface Restoration”.

3.2 DUCT INSTALLATION

- A. Slope: Pitch ducts toward handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends at other locations, unless otherwise indicated.
- C. Joints: Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition.
- E. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- F. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.
- G. Concrete-Encased Ducts: Support ducts on duct separators.
 - 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
 - 3. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 - 4. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
 - 5. Identify Ductbank with one of the following methods:

- a. Mark the top of all underground duct runs with concentrated red dye or powder on top.
- b. Provide 6” wide yellow plastic tape, with black letters indicating “Electric”; place approximately 18” above and continuously along the centerline of duct bank.

3.3 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: Set covers of handholes 1 inch above finished grade and boxes with bottom below the frost line.
- D. Field-cut openings for ducts and 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.

3.4 CLEANING

- A. Pull mandrel through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 26 0543

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Identification for conductors and communication and control cable.
 2. Wiring device circuit identification.
 3. Warning labels and signs.
 4. Equipment identification labels.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WIRING DEVICE CIRCUIT IDENTIFICATION

- A. Marker Tape: Self-laminating, clear polyester, 3/8" high tape with black lettering.
- B. Provide label on every wiring device cover plate, indicating panel and circuit breaker fed from. Utilize 12 pt. font. Mount label on face of device cover plate, centered near the top .

2.3 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 mm)."

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Phenolic Label: Adhesive backed, with black letters on a white background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Electrical and Auxiliary Systems Box, Conductor and Cable Identification: Use marker tape to identify field-installed branch circuit, alarm, control, signal, sound, intercommunications, voice, and data wiring connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and cable pull points. Identify by system and circuit designation.
 - 2. Identify panel and branch circuit number(s) on all junction box covers permanently clearly printed with bold black indelible marker.
 - 3. Use system of designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
- B. Equipment on the emergency or standby systems shall be identified with nameplates having a red background. Receptacles, outlets and switches on the emergency systems shall be identified red. Utilize red devices or provide a pre-manufactured coverplate with "EMERGENCY" engraved on the face with red infill.
- C. Conduit and junction boxes:

1. Color code or label all junction boxes and exposed conduit at 20 ft. intervals. Coding shall be painted or labels of the pre-manufactured type permanently mounted with metal or plastic band.
 2. Label panelboard and branch circuit number(s) on outside of junction box cover at all junction boxes containing branch circuit wiring. Labelling shall be neatly done utilizing black indelible ink markers.
 3. Paint all junction boxes and covers for fire alarm wiring red.
 4. Provide a color identification scheme under heavy plastic cover hanging in the electrical rooms; identification shall be:
 - a) Emergency - Orange
 - b) Normal - Black
- D. Branch circuit panelboards:
1. Identify panel designation on directory card within the panel.
 2. Fill out branch circuit directory indicating circuit number and area served, rooms, group of rooms, lighting, convenience outlets, motors, etc. Card index shall be neatly typed.
 3. Replace branch circuit directory in existing panelboards in areas of alteration.
 4. Branch circuit phase conductor color format shall be permanently identified inside each panelboard.
- E. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated phenolic label. Unless otherwise indicated, provide a single line of text with 1/4-inch- high letters on 5/8-inch- high label; where 2 lines of text are required, use labels 1 inch high.
 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.

- b. Electrical switchboards.
 - c. Transformers.
 - d. Disconnect switches.
 - e. Enclosed circuit breakers.
 - f. Motor starters/VFD's.
 - g. Lighting Relay Panel(s).
3. Label shall include equipment name, voltage and where fed from. Where equipment is located in finished spaces, accessible to the public, in addition to adhesive, secure labels with screws, one on each end.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded feeder, and branch-circuit conductors.
 1. Color shall be factory applied.
 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White
 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow
 - d. Neutral: Grey.

END OF SECTION 26 0553

SECTION 26 0563 – SPECIFIC WIRING APPLICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Various items of equipment require additional electrical connections, wiring and/or interlocks that are not specifically identified on the drawings or in the specifications. Included, but not limited to, are the following items:
 - 1. Kitchen, and laboratory equipment.
 - 2. Mechanical/HVAC Equipment and motors.
 - 3. Plumbing Equipment and Medical Gas Equipment/Alarm Panels
 - 4. Exterior Lighting Control Equipment.
 - 5. Motorized Doors.
 - 6. Security/Access Control Equipment.
 - 7. Fire Protection/Suppression Equipment.

1.2 COORDINATION

- A. Coordinate wiring requirements and interlocks for equipment provided by other Contractors. Obtain copies of approved Shop Drawings and/or manufacturer's wiring diagrams to determine exact wiring requirements.
- B. This Contractor shall inquire of the Engineer during bidding, or at the earliest practical date, any questions which may arise regarding the intention and scope of this work.

PART 2 - PRODUCTS

- 2.1 Materials and equipment shall be as indicated on the drawings and in the specifications.

PART 3 - EXECUTION

- 3.1 Final connections to fixture pigtails shall be made with approved pressure connectors such as IDEAL “Twister” or T&B “Freespring Winged”.
- 3.2 Miscellaneous Equipment Connections
 - A. Various items of equipment such as kitchen, laboratory, laundry, HVAC, Plumbing, etc. will be furnished and set in place by other trades. This equipment, unless otherwise shown on the drawings, will be furnished with necessary electrical outlets, operating and control switches, terminating in an electrical outlet box, or equivalent electrical connector located on the

equipment. This contractor shall furnish power wiring to these various items of equipment and connect them up complete for full operation.

- B. Where disconnect switches are indicated or where otherwise required, they shall be mounted in an accessible location. In the case of labs, kitchens, laundries and finished areas, provide NEMA 4X Stainless Steel enclosure and locate in as inconspicuous a place as possible. Locate disconnect switches under counters where feasible and accessible in lieu of above counter, however, this contractor shall ensure that the installation of equipment does not interfere with access and operation of such switches.
- C. Where necessary to expose conduit in finished spaces, rigid aluminum conduit and conduit body (“LB”) fittings shall be utilized.
- D. Coordinate and provide any additional 120 volt power connections required for special low voltage systems devices or equipment panels such as Security System/Door Access System control panels, door strikes, surveillance cameras, security/fire shutters or doors, temperature control system panels/transformers, etc.
- E. Roughing-in drawings for equipment shall be obtained from the Architect or Contractor providing the equipment with substantial time prior to the installation of such equipment to enable proper electrical rough-in equipment.

3.3 Miscellaneous Wiring Interlocks

- A. Various items of work are required in connection with interlocking motor and starter/VFD operations and providing wiring to serve equipment which is furnished by other trades.
- B. Interlocks between motor controllers for purposes of accomplishing sequence control or simultaneous operation of motors are all to be included in the Electrical Contract. Requirements for a simple simultaneous motor operation interlock are indicated by a schedule on the drawings or by specific notes. These interlocks consist of auxiliary contacts on the starter/VFD of the lead motor wired in, according to standard diagrams of the motor starter/VFD manufacturer to energize the holding coil of the starter or VFD control input for the motor. These interlocks shall be thru the “automatic” position only of the starter/VFD where HOA switches are supplied. Furnish extra contacts on external relays as required for interlocks. Where interlocks, other than the simple sequence above, are required, they shall be as described as follows in this section.
- C. Air handling unit motors shall lead and exhaust fans and moving media air filters (if applicable) follow. Chiller pumps shall lead, followed by chiller, condenser pump and cooling tower, in that order. Condenser pumps shall lead and chemical feeder shall follow. Hot water pumps shall lead and boilers follow.
- D. All safeties, such as freezestats and firestats for air handling systems or high temperature/pressure switches for pumping systems, where required to be wired by the Electrical Contractor, shall be wired thru both the “Hand” and “Automatic” positions.
- E. The following is a list of equipment and systems requiring wiring. Note that these are in addition to standard interlocks scheduled on the drawings.

1. Exterior lighting control shall consist of a combination multiple circuit timer and photoelectric cell system furnished by this Contractor. Controls shall be equal to Tork Time Controls, Inc. Model T930-LE for 3 circuit (Model T920-LE for 2 circuit) (Series 7000 timer for one circuit without photocell); or equal by Paragon, Grasslin or Sangamo. Provide photoelectric cell, arranged and wired to turn on lights automatically at a pre-determined light level. The photocell shall be mounted on the North wall of the building, facing North, away from interfering light sources and wired to the contactor/controller assembly. Timer shall be mounted in a NEMA 1 lockable enclosure. Include a hand-off-auto (H-O-A) switch to bypass automatic operation. Control circuit shall operate electrically-operated, electrically held contactor to control lights. Provide auxiliary relay with contactor where required. Where the drawings indicate a different configuration/assembly for exterior lighting control, the drawings shall take precedence.
2. Smoke dampers with 120 volt damper operators (approximately 0.25A) are provided by the HVAC Contractor. The Electrical Contractor shall provide 120 volt emergency power supply to each operator wired thru a dry contact in the smoke detector or a smoke detector/fire alarm control relay specifically associated with the smoke damper to close the damper on activation of the detector.
3. Motorized backdraft dampers on exhaust fans and power roof ventilators shall be connected to their respective associated motor leads to energize the backdraft damper motor and open the damper when the fan operates. Dampers, operator and transformer, if required, will be furnished by the fan supplier, install transformer and wire to damper.
4. Motorized Doors: Door controls, including door switches (pressplates, prox sensors, etc.), limit switches, relays, etc. will be furnished by the door equipment supplier. This equipment shall be turned over to the Electrical Contractor and installed for a complete and operational motorized door operator system per the equipment supplier wiring diagrams. Provide additional boxes, conduit and wiring as required per the supplier's diagrams and to meet field conditions. Where motorized door operators are located in fire walls and/or smoke partitions, provide a signal from the fire alarm system to disable the door controls to allow it to be manually operable while maintaining it's latching feature.
5. Boiler re-circulating pump starters shall be equipped with an auxiliary contact to accommodate an interlock between the boiler and the pump. Wiring on this control shall be in the Electrical Contract.
6. Power supply for heat tapes shall be provided as indicated on the drawings. Heat tapes are specified under the HVAC Contract. Coordinate with the HVAC Contractor for detailed location and method of connection. Provide ground fault protection of equipment per NEC Article 427.
7. Independently mounted controllers furnished by others: Where starters/VFD's are furnished by other trades, and are required to be mounted remote from the motor, the Electrical Contractor shall accept and mount them and perform all power and control wiring between the controls and motors indicated. Motor controllers equipped with automatic alternators shall have two independent circuits and control sources to preclude loss of operation when one circuit fails.
8. Dental gas alarm panels, both master alarm and area/remote alarm panels, are provided by the Plumbing Contractor. The Electrical Contractor shall provide 120 volt emergency

power supply to each panel. Wiring from the panels to pressure switches and other devices will be provided by the Plumbing Contractor.

9. Pre-Action or dry-pipe fire suppression panel(s) will be provided by the Fire Suppression Contractor. In addition to the required fire alarm system monitoring/control devices specified elsewhere in this specification, this Contractor shall provide any necessary 120 volt emergency power supply to panel for control and/or integral air compressor.

END OF SECTION 26 0563

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Indoor occupancy sensors.
- B. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Current.
 - 2. Leviton Mfg. Company Inc.
 - 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 4. Watt Stopper (The).
 - 5. Sensorswitch.
 - 6. Greengate.
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
 - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.

2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
- C. Dual Technology Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.
- D. Emergency Bypass Relays:
1. Where an emergency power system is available and plans indicate control of emergency lighting via occupancy sensor controls, provide U.L. 924 Listed emergency bypass relay(s) to illuminate emergency lighting from emergency power system during a normal power outage.
- E. Application:
1. Utilize sensor type to best apply to the area it controls (i.e. office, corridor, restrooms, etc.) and provide proper quantity and spacing of sensors to adequately cover the entire area it serves.
 2. Sensors shall be located and adjusted in private office to prevent incidental activation from passerby in hallways or sensor shall utilize 'adaptive' technology to recognize usage patterns and adjust sensitivity.
 3. Provide override switch where indicated on plans to disable operation of sensor and leave lights off.

2.2 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 95 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. After construction period and just prior to turn-over of facility for beneficial use, reset all sensors that are "Adaptive Technology" (or "Smart Technology") to initiate their "learning mode" while in use by the Owner during move-in and beneficial use. Follow up with necessary sensor adjustments within 15 working days.
- C. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 26 0923

SECTION 26 0936 - MODULAR DIMMING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes manual modular dimming controls.

1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL DIMMING DEVICE REQUIREMENTS

- A. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.
- B. Dimmers and Dimmer Modules: Comply with UL 508.
 - 1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
 - 2. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

2.2 MANUAL MODULAR MULTISCENE DIMMING CONTROLS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Leviton Mfg. Company Inc.
 - 2. Lightolier Controls.
 - 3. Lutron Electronics, Inc.
 - 4. Lehigh, Inc.
- B. Description: Factory-fabricated equipment providing manual modular dimming control consisting of a wall-box-mounted, master-scene controller and indicated number of wall-box zone stations. Controls and dimmers shall be integrated for mounting in one-, two-, or three-

gang wall box under a single wall plate. Each zone station shall be adjustable to indicated number of scenes, which shall be recorded on the zone controller.

- C. Operation: Automatically change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.
- D. Each manual modular multiscene dimming controller shall include a master control and remote controls.
- E. Each zone shall be configurable to control the following:
 - 1. Fluorescent lamps with electronic ballasts.
 - 2. Incandescent lamps.
 - 3. Low-voltage incandescent lamps.
- F. Memory: Retain preset scenes through power failures for at least seven days.
- G. Device Plates: Style, material, and color shall comply with Division 26 Section "Wiring Devices."
- H. Master-Scene Controller: Suitable for mounting in a single flush wall box.
 - 1. Switches: Master off, group dim, group bright, and selectors for each scene.
 - 2. LED indicator lights, one associated with each scene switch, and one for the master off switch.
- I. Fluorescent Zone Dimmer: Suitable for operating lighting fixtures and ballasts specified in Division 26 Section "Interior Lighting," and arranged to dim number of scenes indicated for the master-scene controller. Scene selection is at the master-scene controller for setting light levels of each zone associated with scene.
 - 1. Switch: Slider style for setting the light level for each scene.
 - 2. LED indicator lights, one associated with each scene.
 - 3. Electrical Rating: 1000 VA, 120 V minimum or as noted or scheduled on the drawings.
- J. Incandescent Zone Dimmer: Suitable for operating incandescent lamps at line-voltage or low-voltage lamps connected to a transformer and arranged to dim number of scenes indicated for the master-scene controller. Scene selection shall be at the master-scene controller for setting light levels of each zone associated with scene.
 - 1. Switch: Slider style for setting the light level for each scene.
 - 2. LED indicator lights, one associated with each scene.
 - 3. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.

2.3 CONDUCTORS AND CABLES

- A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

- B. Class 2 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" for identifying components and power and control wiring.
- B. Label each dimmer module with a unique designation.
- C. Label each scene control button with approved scene description.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Continuity tests of circuits.
 - 2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

- a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
- C. Remove and replace malfunctioning modular dimming control components and retest as specified above.
- D. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
- E. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

END OF SECTION

SECTION 26 2213 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Indicate dimensions and weights.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Field quality-control test reports.
- E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ACME Electric Corporation; Power Distribution Products Division.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 3. Siemens Energy & Automation, Inc.

4. Sola/Hevi-Duty.
5. Square D; Schneider Electric.
6. General Electric (GE).

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 1. Internal Coil Connections: Brazed or pressure type.
 2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Cores: One leg per phase.
- D. Enclosure: Ventilated, NEMA 250, Type 2.
 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- E. Transformer Enclosure Finish: Comply with NEMA 250.
 1. Finish Color: ANSI 49 gray.
- F. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.
- G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- H. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- I. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 1. Complying with NEMA TP 1, Class 1 efficiency levels.
 2. Tested according to NEMA TP 2.
- J. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
- K. Wall Brackets: Manufacturer's standard brackets.

2.4 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic nameplate. Nameplates are specified in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
- B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions and requirements in Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Furnish and install a vibration isolation pad at each corner of each transformer to isolate from structure or support frame. Vibration isolation pads shall be selected for appropriate weight and bearing area; by Mason or B-Line or equal.

3.2 ADJUSTING

- A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION 262200

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SECTION 26 2413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Include listed and labeled rating for the available short circuit current and the fuse/circuit breaker combinations indicated on the drawings.
3. Include schematic and wiring diagrams for power, signal, and control wiring if applicable.

C. Field quality-control reports.

D. Operation and maintenance data.

1.3 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 NEMA PB 2.

C. Comply with NFPA 70.

D. Comply with UL 891.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace devices (not including fuses) that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D; a brand of Schneider Electric.
 - 4. General Electric (GE).
- B. The switchboard shall be Type 1 General Purpose, totally enclosed, dead front, free standing, front and rear aligned with front accessibility only required. The framework shall be of UL gauge steel and secured together to support all bussing, component devices, and coverplates during shipping and installation. Formed steel removable closure plates shall be used on the front, rear, sides and top plate. Provide bottom closure plate where Code requires such. All closure plates shall be removable utilizing a single tool. Ventilation openings shall be provided when required. Where indicated on drawings to meet field conditions, provide additional header box at top of switchboard to accommodate horizontal conduits from switchboard in lieu of vertical conduits. Header box shall have removable panels on all sides to enable pulling feeders.
- C. Enclosure Finish: Factory-applied finish in ANSI #61 medium light gray, UL listed acrylic baked paint finish over a rust-inhibiting, corrosion-resistant primer on treated metal surface.
- D. The entire assembly shall be suitable for operation at the available fault current listed on the drawings and shall be labeled accordingly to indicate the maximum available fault current that the assembly, including branch devices is capable of withstanding. The entire breaker and fuse short circuit and overcurrent protective system shall be UL Fully Rated System.
- E. Switchboard thru-bus shall be tin-plated or silver-plated copper, rated to full capacity of the main switch or breaker frame size of the main overcurrent device or ampacity indicated on the drawings and shall extend the full length of the switchboard. Bussing shall be of sufficient cross sectional area to meet UL 891 for temperature rise. The thru-bus and neutral bus shall be 100% rated and shall have provisions for future splicing to add sections at either end..
- F. Switchboard distribution section bus shall be full height of the same material and construction as the thru-bus and shall be rated as indicated on the drawings or sized for the devices installed and for all future devices capable of being installed in that section. The section neutral bus shall be 100% rated and provided with lugs for the devices installed and future devices specified.

- G. The ground bus shall be copper and shall run continuous through each section. Ground bus shall be securely bolted to all structures in the assembly. Bus shall be sized per UL Standard 891 and shall have cable clamps suitable for making all ground connections. Provide a removable link between the neutral bus and ground bus. Connect all ground conductors to ground bus in switchboard.
- H. Coordinate shipping splits to suite job site conditions. Include removable type lifting hooks and a wooden skid to permit unloading and rolling into its final location in the building.
- I. A short circuit and coordination study complete with curves shall be furnished by the switchboard manufacturer which demonstrates proper interrupting ratings, coordination between the main and feeder breakers and ground fault protection. Provide recommended settings for the breakers and the ground fault protection. **This study must be submitted with the shop drawings. Shop drawings will be rejected if Study is not provided with Submittal.**
- J. Include Arc Flash Evaluation Studies using the NFPA 70E or IEEE 1584 Standard to comply with NEC paragraph 110.16. Provide, in report form, the results of the calculations and install labels/markings on switchboards and panelboards that are subject to require examination, adjustment, servicing or maintenance while energized. **These studies must be submitted with the shop drawings. Shop drawings will be rejected if Study is not provided with Submittal.**

2.2 SURGE PROTECTIVE DEVICES

- A. Provide a Surge Protective Device (SPD) on the load side of the main switch; refer to Section 26 4313. The SPD shall be factory mounted and wired with remote status panel in front hinged door of that switchboard section. All wiring passing across the door hinge shall be extra flexible and shall be protected in a flexible non-metallic sheath. Barrier off section from switchboard bussing. Serve SPD from an adjacent fused switch or breaker, refer to drawings and SPD manufacturer's recommendations; fuse size and type as recommended by the SPD manufacturer shall be shown on the switchboard shop drawing submittal. Circuit conductors shall not exceed 18 inches in length and shall be twisted together along entire length.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Main switch and all switches 800 amps and above shall be bolted pressure type "Bolt-Loc" by Square D, "CBC" by Pringle or Boltswitch and shall incorporate the following features:
 - 1. Load break type with NEMA Class L fuse accommodations; all current carrying connections shall be tin-plated or silver-plated. Fusing shall be located on the load side of the switch. A mechanical or Kirk-Key interlock shall permit the use of a fuse access only when switch is in the off position and shall prevent switch operation when door is open. Handles shall have provisions for padlocking in the off position.
 - 2. The stored energy dead front operating mechanism shall include springs, compressed and released by the operating handle, to provide quick positive-shifting action independent of the speed with which it is operated. The mechanism shall be designed so that the switch can be closed only after the opening spring has been charged. The switches shall have an interrupting rating of 12 times continuous rating.
 - 3. Provide blown fuse protection which trips the switch on blowing of any of its fuses.

4. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
 - a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
 5. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
 6. Service-Rated Switches: Labeled for use as service equipment.
 7. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
 - a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 8. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- B. Switchboard shall contain sub-distribution type fusible panels which contain fusible switches group mounted complete with bus bars in an integrated assembly. Switches shall be quick-make, quick-break, arc quenching type and mechanically interlocked to prevent access to the fuse unless the switch is in the open position. Handles shall have provisions for padlocking in the off position. Fuse holders shall be designed for Class "R", rejection type fuses, equal to Bussman "Low-Peak" Class R.
- C. Fuses are specified in Division 26 Section "Fuses."

2.4 INSTRUMENTATION

- A. Provide heavy duty metering instruments designed for switchboard use. Mount instruments on a front hinged door for access to internal wiring connections. Provide shorting terminal blocks on all CT circuits. All wiring passing across the door hinge shall be extra flexible and shall be protected in a non-metallic sheath. Metering instrumentation shall consist of the following:
1. One digital power meter with current (each phase), voltage (phase-to-phase and phase-to-neutral), power factor, THD, maximum, minimum, instantaneous, kWh and 15 minute kWd demand readings. Power meter shall have local digital backlit LCD (or LED) display. Power meter shall utilize standard switchgear style CT's with 5A secondaries. Metering voltage input may be direct wired to the bus up to 600 vac (no PT's required) or through switchgear style PT's up to 1.7 MV. Meter shall be Square D model PM820 or equal by Cutler-Hammer, Siemens, GE, Electro-Industries or Power Measurements Ltd.

2.5 CONTROL POWER

- A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

- B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
- C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.6 IDENTIFICATION

- A. Refer to “Electrical Identification” Section for switchboard nameplate requirements. Switchboard shall have “Main Nameplate” indicating switchboard name, ampacity and voltage as well as nameplates for individual sub-distribution components indicating panel, equipment or device, etc. that it serves and it’s general location. Submittals shall include nameplate identification for review and comments.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install switchboards and accessories according to NEMA PB 2.1.
- B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness.
 - 1. Switchboard shall be set level on a base channel and bolted securely to the concrete base.
- C. Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- D. Install filler plates in unused spaces of panel-mounted sections.
- E. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation that are not factory installed and shipped in switchboard assembly.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges based on manufacturer’s coordination study or as shown on the drawings if indicated.

3.2 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Switchboard will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 2413

SECTION 26 2416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 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. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Panelboard schedules for installation in panelboards.
- D. Operation and maintenance data.

1.3 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 NEMA PB 1.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and/or surface-mounted cabinets, as indicated on the drawings.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

- b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen/Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
 - B. Incoming Mains Location: Top and/or bottom as Project condition dictates.
 - C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
 - D. Conductor Connectors: Suitable for use with conductor material and sizes.
 1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs: Mechanical type.
 3. Ground Lugs and Bus Configured Terminators: Mechanical type.
 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
 - 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 symmetrical short-circuit current available at terminals.
 - H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cutler-Hammer.
 2. Siemens.
 3. Square D.
 4. General Electric (GE).
- 2.2 DISTRIBUTION PANELBOARDS
- A. Panelboards: NEMA PB 1, power and feeder distribution type.
 - B. Doors: Secured with vault-type 3 point latch with tumbler lock; keyed alike.
 - C. Mains: Lugs only as identified on the drawings.
 - D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker and/or lugs only as identified on the drawings. Sized to have 225 amp bussing unless indicated otherwise on drawings.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units. Sized to accommodate 42 poles unless indicated otherwise on drawings. Furnish number of breakers shown.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents listed on the drawings.
 - 1. 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.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 - 4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 6. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 - 7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles. Where more than one pole is used, they shall employ a common trip.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits. Type HACR for feeding heating, air conditioning and refrigeration equipment.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Shunt Trip: 120 -V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

- f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- B. 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 Division 26 Section "Fuses."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of lighting and appliance panelboard trim 72 inches above finished floor; distribution panelboard trim 90 inches above finished floor, unless otherwise indicated.
- C. 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.
- D. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges and ground fault settings as applicable.
- E. Install filler plates in unused spaces.
- F. Stub four 1-inch empty conduits from flush mounted panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- H. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Switchboards or panelboards containing a 4-wire, delta connected system where the midpoint of one phase winding is grounded shall be legibly and permanently field marked to indicate "high phase leg to ground" per (2017) NEC 408.3(F).
- C. Create a directory to indicate installed circuit loads and incorporating Owner's final room, area or equipment designations. Temporary conditions of occupancy shall not be utilized as circuit descriptions. Indicated spare circuits shall be specifically labeled as such. Obtain approval

before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

- D. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- E. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 2416

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SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Wall-box motion sensors.
 - 3. Snap switches and wall-box dimmers.
 - 4. Solid-state fan speed controls.
 - 5. Wall-switch and interior occupancy sensors.
 - 6. Communications outlets.
- B. See Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Legrand).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper; 5351 (single), 5352 (duplex).
- b. Hubbell; 5361 (single), 5362 (duplex).
- c. Leviton; 5351 (single), 5352 (duplex).
- d. Pass & Seymour; 5361 (single), 5362 (duplex).

B. Hospital Grade Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper; 8300 (duplex).
- b. Hubbell; HBL8300 (duplex).
- c. Leviton; 8300 (duplex).
- d. Pass & Seymour; 8300 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. All receptacles installed outdoors shall be weather resistant type.

C. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper.
- b. Pass & Seymour/Legrand.
- c. Leviton.
- d. Hubbell.

2.4 TAMPER RESISTANT STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, NEC 406.12 & 517.18(C) and UL 498.

B. Where indicated on plans to provide Tamper Resistant type receptacle, device shall have non-conductive dual mechanical shutter mechanisms on 120V connection ports, compliant with NEC requirements. This is in addition to required device configuration indicated (ie: Standard Straight Blade, Hospital Grade, GFCI, etc.).

2.5 USB CHARGING TYPE RECEPTACLES

- A. Convenience Receptacles, 125V, 20A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, UL 498.
- B. Where indicated on plans to include USB Type Charging ports, device shall include Dual-Port USB Type A-C charging ports with minimum 5 Amps combined charging power (minimum 25 watts), in addition to required device configuration indicated (ie: Standard Straight Blade, Hospital Grade, GFCI, Tamper-resistant, etc.).

2.6 NIGHT LIGHT ACCESSORY

- A. Where indicated on plans to include night light accessory ("NL"), device shall have LED night light, integral with the face of device and photo-sensor for control of night light function. This is in addition to required device configuration indicated (ie: Standard Straight Blade, Hospital Grade, GFCI, Tamper-resistant, etc.).

2.7 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221PL for 120 V and 277 V.
 - b. Hubbell; HPL1221PL for 120 V and 277 V.
 - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - d. Pass & Seymour; PS20AC1-PLR for 120 V.
 - 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
 2. Description: Single pole, with factory-supplied key in lieu of switch handle.
- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995.
 - b. Hubbell; HBL1557.
 - c. Leviton; 1257.
 - d. Pass & Seymour; 1251.
- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995L.
 - b. Hubbell; HBL1557L.
 - c. Leviton; 1257L.
 - d. Pass & Seymour; 1251L.

2.8 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, 0-10V, solid-state units with integral, quiet on-off switches. Unit listed and compatible for type of lighting controlled and rated for connected load unless larger rating is indicated for future capacity.
- B. Control: Continuously adjustable slider, with separate on-off switch; single-pole or three-way switching capability. Comply with UL 1472.

2.9 OCCUPANCY SENSORS

- A. Wall-Switch Sensors:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, manufacturer shall match that submitted for ceiling mounted occupancy sensors.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

2.10 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: Nylon.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.
 1. Outdoor receptacle covers shall be "In Use" type rated "Extra Duty".

2.11 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Round, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, black finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: As noted on plans or as indicated in applicable specification section.

2.12 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 1. Wiring Devices: Ivory, unless otherwise indicated or required by NFPA 70 or device listing. Switches, receptacles and coverplates for emergency lighting shall match color and type of normal lighting switches.
 2. Device plates: Nylon, to match color of wiring devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. 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 the boxes.
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.
5. All 15 or 20 amp-120V wiring devices located within 6 feet from the edge of a sink, located in Kitchens or Bathrooms or serving electric water cooler shall be GFCI protected type device.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
3. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
3. When there is a choice, use side wiring with binding-head screw terminals.
4. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
5. Tighten unused terminal screws on the device.

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 bottom. Group adjacent switches under single, multigang wall plates.

3.2 "PLUG CONNECT/PLUG TAIL" DEVICES

- A. In lieu of terminal screw connected receptacles and switches as specified above, specialized plug-in type devices may be provided as long as it is offered by the same manufacturer and listed equivalent to the same product line specified. Permanent wiring pigtails shall be of sufficient length to enable replacement of device with standard terminal screw type device as required by Code.
- B. Where plug-in type wiring devices are provided, furnish a minimum of five (5) of each type and color device installed to the Owner as spares. Where more than one hundred (100) of any type is installed, provide a minimum of ten (10) spare devices.

3.3 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. 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 not acceptable.
 - 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.

END OF SECTION 26 2726

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SECTION 26 2813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cartridge fuses rated 600-V ac and less for use in, enclosed switches, panelboards, enclosed controllers and motor-control centers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cooper Bussman, Inc.
 - 2. Mersen.
 - 3. Littelfuse.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

- A. Feeders: Class RK1, time delay.
- B. Motor Branch Circuits: Class RK1, time delay.

- C. Other Branch Circuits: Class RK1, time delay.
- D. Control Circuits: Class CC, fast acting.

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 26 2813

SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Fusible switches.
 2. Nonfusible switches.
 3. Shunt trip switches.
 4. Molded-case circuit breakers (MCCBs).
 5. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 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/NON-FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cutler-Hammer.
 2. Siemens.
 3. Square D.
 4. General Electric (GE).
- B. All starters and disconnect switches shall be of the same manufacturer unless otherwise approved.

- C. Type HD, Heavy Duty, Single Throw, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses specified when so indicated on the drawings, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. 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 SHUNT TRIP SWITCHES (Elevator Power Module)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Ferraz Shawmut, Inc.
 - 3. Littelfuse, Inc.
 - 4. Square D.
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- E. Accessories:
 - 1. Oiltight key switch for key-to-test function.
 - 2. Oiltight ON pilot light.
 - 3. Isolated neutral lug.
 - 4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 - 5. Form C alarm contacts that change state when switch is tripped.
 - 6. Three-pole, double-throw, fire-safety and alarm relay; 24-V dc coil voltage.
 - 7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cutler-Hammer.
 - 2. General Electric Company.
 - 3. Siemens.
 - 4. Square D.
- 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. 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. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 4. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 5. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.

2.4 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.
 - 3. Kitchen/Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 5. 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 6'-0" A.F.F. unless otherwise indicated.
- B. Install fuses in fusible devices.

- C. Coordinate location of devices to allow working clearances and to avoid interference with other equipment and trades.
- D. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

END OF SECTION 262816

SECTION 26 3213 – EMERGENCY POWER SYSTEM (Diesel Fueled)

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide a standby power system to supply electrical power in event of failure of normal supply consisting of a liquid cooled engine, an AC alternator with main breaker and system controls, fuel system including fuel tank, and piping, exhaust system with muffler and piping and cooling system. Refer to the drawings for capacities and electrical characteristics.
- B. Rating indicated on the drawings is for standby service with 100 hours or less per year operating time.
- C. The electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested as a complete unit, on a representative engineering prototype model of the equipment to be sold.
- D. See Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with ASME B15.1.
- E. Comply with NFPA 37.
- F. Comply with NFPA 70.
- G. Comply with NFPA 99.
- H. Comply with NFPA 101.
- I. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- J. Comply with UL 2200, package unit shall be listed and labeled.
- K. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

- L. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.3 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: 2 year(s) from date of Substantial Completion/Beneficial Use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The generator set shall be of standard design with complete factory assembly by Caterpillar, Cummins-Onan or Kohler.

2.2 ENGINE-GENERATOR SET

- A. The engine set shall be diesel fueled, four cycle for heavy duty industrial application, rated to deliver the specified capacity at an ambient temperature of 104 degrees F (40 degrees C), and an elevation of 1000 ft. above sea level. Engine shall develop approximately 1.5 HP for each KW of generator, after deducting the HP required for the unit mounted fan and pump operation. Maximum speed at rating – 1800 RPM, ratings shall be those in standard published curves and data. Special test ratings for non-standard products will not be acceptable. Engine shall incorporate all standard equipment including:

- 1. Liquid cooling radiator, engine mounted, with engine driven fan, duct flange and fan guard; engine driven water pump and closed coolant recovery system providing visual diagnostics means to determine if the system is operating with normal coolant level. The radiator shall be designed for operation in 110 degrees F ambient temperature.
- 2. Engine mounted intake air filter(s) with replaceable element.
- 3. Full pressure engine lubrication supplied by a positive displacement lube oil pump. Engine shall have a replaceable filter with internal bypass and replaceable elements.
- 4. Provide engine coolant and oil drain extensions to outside of the mounting base for cleaner and more convenient engine servicing.
- 5. The engine fuel system shall be designed for operation on No. 2 diesel fuel. A secondary fuel filter, water separator, manual fuel priming pump, fuel shutoff solenoid and all fuel lines must be installed at the point of manufacture.
- 6. Sensing elements shall be located on the engine for low oil pressure shutdown, high coolant temperature shutdown, low coolant level shutdown, over speed shutdown and over crank shutdown. These sensors are to be connected to the control panel using a wiring harness with the following features: wire number labeling on each end of the wire run for easy identification, a molded rubber boot to cover the electrical connection on

each sensor to prevent corrosion and all wiring to be run in flexible conduit for protection from the environment and any moving objects.

7. Steel base for engine-generator with adjustable spring type vibration isolators.
8. Electronic governor capable of maintaining alternator frequency within 0.5% from no load to full load alternator output. Steady state regulation is to be 0.25% (Woodward 2301 Electro-Hydraulic governing system or equal by Barber-Coleman.)
9. Electric jacket water (block) heater(s) with 120 or 208 volt power source; each thermostatically controlled and used to aid in quick starting.

2.3 OVERCURRENT PROTECTION, INSTRUMENTATION AND ALARMS

- A. The Main Line Breakers shall be molded case solid state-electronic trip, 100% rated type for load circuit breaking and line protection. Breaker shall be sized for minimum 115 to 125% full capacity of generator output. Generator exciter field circuit breakers are not acceptable substitute.
- B. Control instruments and alarms (NFPA-110) shall be microprocessor based and shall be mounted in an engine mounted control panel (with vibration isolators) and shall include the following:
 1. Oil pressure gauge and alarm light (pressure gauge can mount on engine).
 2. Water temperature gauge with high temperature alarm light (temperature gauge can mount on engine).
 3. Running time meter.
 4. Voltmeter with selector switch, phase to phase, phase to neutral and off.
 5. Ammeter with selector switch, each line and off.
 6. Frequency meter.
 7. Battery charging ammeter.
 8. Over speed shut down alarm light.
 9. Unit auto-run-stop with remote start from automatic transfer switch.
 10. Voltage level adjustment rheostat (can mount on engine).
 11. Safety shut offs for high water temperature, low oil pressure, over speed and engine over crank; fault light and alarm contact for each.
 12. Means for remote shutdown of generator per NEC 445.18(B) (provide maintained contact emergency stop button and means to wire button to unit).
 13. Alarm light for main storage tank low fuel level.
 14. Alarm light for intertank leak detection – for main belly tank.

15. Indication of all alarms required by NFPA 110; include provisions for remote annunciation.
 16. Main line circuit breaker(s). Circuit breaker(s) shall have means to lock in the open position per NEC 445.18(A).
 17. Relay with normally closed contact for damper control.
 18. Circuit breaker and motor starter for remote radiator motor; mount in same enclosure as main circuit breaker.
 19. Ground fault indicator to comply with NEC 700.7(D) where system voltage to ground is more than 150 volts and output breaker is 1000 amps or more.
 20. Manual/off/auto switch; four LED's to indicate: not in auto, alarm active, generator running, generator ready.
 21. Provide monitoring of generator start signal control wiring as required by NEC 700.10(D)1, for Emergency Power Systems, to provide audible and visual annunciation, as well as start generator, upon loss of start circuit integrity.
- C. Surface mounted remote annunciator(s) of all alarms required by NFPA 110; locate the annunciator(s) as shown on the floor plans. Include red and green lamps indicating position of each automatic transfer switch.

2.4 GENERATOR FEATURES

- A. Features include the following:
1. The AC generator shall be synchronous, four pole, optimum pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan and directly connected to the engine with flexible drive disc or flexible steel coupling – provide guard.
 2. Consult tank manufacturers about capacities available for size of set in Project.
 3. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 130 degrees Centigrade.
 4. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5% above or below rated voltage.
 5. Determine applicable codes and regulations, and coordinate subparagraph below with Drawings.
 6. Design and construction conforming to NEMA, AIEE and ASA standards.
 7. Static excited and static regulated, 12 lead brushless revolving field.

8. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.
9. Voltage regulation plus or minus 1%.
10. Radio interference suppression.
11. Capability to assume rated load in one step with less than 15% transient voltage dip with normal voltage recovery in one second.
12. Power factor 0.8; at 60 Hz.

2.5 ACCESSORIES AND WEATHERPROOF HOUSING

A. Furnish and connect the following engine accessories:

1. Heavy duty 12 volt or 24 volt lead acid starting batteries and charger. Battery charger shall be heavy duty potted assembly for waterproof and vibration resistance, designed for operation with an engine cranking battery. Universal voltage input with cord and plug connection and multi-stage charging modes of operation. The battery shall not be discharged through the battery charger.
2. Flexible stainless steel exhaust connection for each exhaust outlet.
3. Critical type exhaust silencer, Maxim #M51 or equal by Burgess, EM Products Inc., Universal "ENS", York "Y4" or Cowl. Provide crossover manifold where engine has more than one exhaust outlet. Provide ventilated roof/wall thimble to accommodate exhaust piping; coordinate with General Contractor and HVAC Contractor to comply with specific installation requirements.

B. Sub-base mounted fuel oil tank shall be double wall constructed of steel plate of thickness required by applicable standards and shall be UL listed and constructed per NFPA requirements; manufactured by MO Trailers Corporation, Pryco, Victory Industrial Products or approved equal.

1. Tank shall include necessary vent, fill, fuel level gauge, supply and return openings, piping and accessories. Provide vent line to outside with approved cast iron screened rain shield; must be installed with proper clearance from all building openings.
2. Tank shall meet State of Ohio Fire Marshal requirements for venting, fuel fill spill containment, overfill protection, tank alarm, signage and associated specific requirements.
3. Tank shall have fuel capacity for 24 hour runtime at full load.

4. Provide an intertank leak detector and alarm contact; connect alarm contact to control panel for local and remote annunciation.
 5. Provide fuel level gauge with alarm contacts; connect alarm contacts to control panel for local and remote annunciation.
 6. Base tank shall be fabricated separately from the base; after fabrication, tank shall be bolted to its base to form a complete unit that mates to the generator skid. Base tank shall not interfere with access to engine and generator for maintenance and shall be mounted to allow minimum 2 inches air space between bottom of tank and concrete floor.
 7. Complete assembly shall be prime and finish painted to match color of engine generator set.
- C. Return fuel cooler mounted to radiator fan housing and piped from return fuel outlet on generator.
- D. Provide a factory installed weather protective type sound attenuating (75 db at 7 meters) housing around generator for outdoor installation (Skin-Tight Enclosure). Standard features associated with housing shall be as follows:
1. Hinged and removable side and rear panels for easy access to generator set.
 2. Vertical outlet hoods with 90 degree angles and baffles or turning vanes to redirect air and reduce noise; UL 94 HF1 listed acoustic insulation for flame resistant standards.
 3. Louvers on both the generator air intake and radiator air discharge ends for cooling; to prevent rain and snow entry.
 4. Lockable latches on each removable or hinged panel; all parts of latches and hinges and mounting hardware shall be stainless steel.
 5. Rugged galvanized steel or aluminum construction; painted with accepted manufacturer's painting process. Skid mounted. Color selected by Architect/Engineer.
 6. Battery rack and battery blanket heater, 120 volt thermostatically controlled.
 7. Insulated critical rated silencer with tail pipe and rain cap; mount silencer inside generator enclosure.
 8. Rodent barriers and insect screens over all openings including louvered openings.

2.6 AUXILLIARY SYSTEMS CONNECTIONS

A. Oil Supply System.

1. All tanks and piping systems and installation shall conform to applicable portions of NFPA 31 and shall meet requirements of the State Fire Marshall.

2. Oil and vent piping shall be schedule 40 threaded coated black steel ASTM A-53 with cast iron screwed standard fittings.
3. Oil piping from the sub-base tank to the generator is in the Electrical Contract. Provide vent line to outside with approved cast iron screened rain shield on end. Vent line must be installed with proper Code clearance from all building openings.
4. Diesel fuel shall be provided by the Electrical Contractor and shall be type and grade as recommended by engine supplier.

2.7 SUBMITTALS

- A. Equipment supplier shall submit for approval with shop drawings, interconnection diagram showing all controls and alarms. Dimensioned drawings of the complete generator assembly, required clearances, exhaust assembly, batteries and rack, etc. Shop drawings submitted without all required information will be rejected. At the completion of the project, these drawings shall be included as part of the maintenance manuals, these drawings shall be specific to the actual project installation and shall not be standard manufacturer model drawings.
- B. Where engine fuel injectors are required to be cooled by engine fuel, the equipment supplier shall include in his costs all additional necessary equipment and labor to modify the fuel system design including fuel cooler and all other piping and electrical work as needed.
- C. Standard color chips shall be submitted with shop drawings for color selection by the Architect and Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110. Confirm installation will allow full access, without removing connections or accessories, for periodic maintenance.
- B. Secure necessary permits and inspections from the Authority Having Jurisdiction for the installation of Aboveground/Underground Fuel Storage Tank(s) that comply with Ohio Administrative Code 1301, Ohio Fire Code, NFPA 30 & 30A as applicable. Provide a copy of approval documentation of tank(s) installation to the Inspection Agency prior to installation and notify the Fire Marshal when ready for inspection for compliance with Ohio Fire Code when applicable.
- C. Install packaged engine generator on 6" high steel reinforced concrete base with adjustable spring-type vibration dampeners or factory installed isolators between engine and skid. Bolt firmly to foundation.
- D. Make external connections to generator and engine thru flexible connections.

- E. Connect auxiliary systems all in accordance with manufacturer's specific instructions for automatic and manual operation.
- F. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems." Neutral shall not be bonded to generator. Bonding of neutral and ground is accomplished in main switchgear. Provide signs at service entrance location and at grounding location per NEC 700.8.
- G. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Furnish and install all control wiring and interlocking between the engine-generator, generator control panel, automatic transfer switch, rupture tank, fuel gauge for belly tank, remote annunciator, remote stop button (located adjacent to ATS's), damper control, auxiliary systems, power to engine block heater, battery charger, etc.
- H. Fill radiator and cooling system with the necessary solution of ethylene glycol, additives and water for freeze and engine component/cooling system protection as recommended by the manufacturer. Provide freeze protection rated to -40 degrees F.
- I. Security enclosure (fencing, minimum of 6' high) shall be provided around generator/tank housing with minimum 4' working clearance, all sides. Generator sub base mounted fuel tanks shall be provided with vehicular barrier protection on all sides of the tank/generator enclosure subject to vehicular damage; located minimum 1 feet from edge of generator security enclosure and minimum 3 feet tall above grade. Refer to Architectural drawings for security fencing and bollards to coordinate generator/base location.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections prior to start-up and to assist in testing.
- B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- C. Operational Test: After electrical circuitry has been energized, start unit(s) to confirm proper motor rotation and unit operation.
- D. Coordinate tests with tests for automatic transfer switches and run them concurrently.
- E. Operational/Load Test:
 - 1. Adjust, test and demonstrate proper operation of the system after installation. Test shall demonstrate automatic operation, transfer, quick start and a minimum of 2 hours endurance under not less than 50% load, with not less than 4 hours at full load. Provide a resistance load bank for the test and all necessary temporary cabling, etc. Coordinate location of load bank with Owner and other trades to ensure safe operation of systems and protection of surrounding areas. Engineer/Associate Architect may require extended test time if system is deemed suspect.

2. Engine-generator system shall pick up full load in less than 10 seconds.
- F. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- G. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. The supplier shall furnish a certified full load test certificate verifying that the generator has been tested prior to delivery and found to be in satisfactory working condition under test loads.
- H. All fuel piping and base mounted fuel tanks shall be tested after installation and before filling with fuel. Tests shall comply with Ohio Administrative Code, Chapter 13.
- I. The Electrical Contractor shall provide fuel for testing and top off the tank after completing all tests and demonstrations.
- J. Exit and emergency lighting and power distribution wiring shall be run in a separate and independent conduit system.
- K. Provide sign at the service entrance indicating type and location of on-site legally required standby power sources per NEC 701.7(A). Coordinate with Authority Having Jurisdiction (AHJ).

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators, allow a minimum of 4 hours for training.

END OF SECTION 26 3213

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SECTION 26 3623 – AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes automatic transfer switches rated 600 V and less.
- B. The Automatic Transfer Switch shall be furnished as a part of the complete package from the Standby Power System and shall be installed/wired by the Electrical Contractor.
- C. The Portable Generator Docking Station may be furnished separately by the Electrical Contractor and shall be installed/wired by the Electrical Contractor.

1.2 GENERAL

- A. Furnish and install electrically operated automatic switch to transfer loads to standby system upon failure of main source of electricity. Unit shall be complete with accessories in NEMA 1 enclosure as shown on the drawings.
- B. Switch shall be electrically operated, mechanically held type with a mechanical interlock to prevent both sides closing simultaneously.
- C. Furnish and install manually operated, double-throw switch with camlock power connections for portable generator connection per requirements of NEC 700.3(F).

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA ICS 1.
- C. Comply with NFPA 70.
- D. Comply with NFPA 99.
- E. Comply with NFPA 110.
- F. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: ASCO Bulletin 300 Series or equivalent by Russelectric, Kohler, Cummins or Caterpillar. Voltage and ampere ratings as indicated on the drawings.
- B. Generator Docking Station by Trystar, Berthold Electric, Square D or Eaton.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the available fault conditions indicated on the drawings, based on testing according to UL 1008.
- C. Microprocessor Controls: Microprocessor based controller with Control and Display Panel mounted on face of door, panel shall have LED source and switch indication lights and membrane interface panel for test and time delay bypass controls.
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
- G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
- H. Neutral Terminal: Solid and fully rated with lugs, unless otherwise indicated.
- I. Enclosures: General-purpose NEMA 250, Type 1 complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 FEATURES AND ACCESSORIES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Signal-Before-Transfer Contacts: Two sets of normally open/normally closed dry contacts (rated 3 amps at 480 volts AC) operates in advance of retransfer to normal source (and in advance of transfer to emergency source when in test mode). Timer intervals adjustable from 0 to 20 seconds for transfer in either direction and independently adjustable/programmable.
- D. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
- E. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated.
- F. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer.
- G. Features:
 - 1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - 2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 - 3. Current Sensors for each phase and neutral of Load Source: Sensors shall be wired to LCD display to allow reading of current for each phase as well as RMS summary load.
 - 4. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - 5. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 15 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - 6. Test Switch: To simulate normal-source failure.
 - 7. Switch-Position Pilot Lights: Indicate source to which load is connected.
 - 8. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate indicating "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate indicating "Emergency Source Available."

9. All pilot/indication lights shall be LED type for long life.
10. Unassigned Auxiliary Contacts: Two normally open/normally closed, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
11. Load Priority/Shed Control and Contacts: For setting (programming) of priority level of transfer switch(es) where more than one transfer switch is connected to emergency/standby power source. Priority 1 Transfer Switch (Life-Safety) shall be first to transfer to emergency source and last to disconnect from emergency source upon return of normal power. Load shed signal(s) shall originate from the generator controller.
12. Terminal provisions for connection of remote test and serial communications port for remote monitoring/annunciation.
13. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
14. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
15. Engine-Generator Exerciser: Microprocessor based, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 14 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

2.5 GENERATOR DOCKING STATION GENERAL REQUIREMENTS

- A. Docking Station Ampacity-Voltage requirements shall be as indicated on the drawings. Provide for Life-Safety System, at a minimum. Provide for other Systems if indicated on drawings.
- B. Enclosure shall be UL 1008 Listed, NEMA 3R rated with multiple single or 3-point latching and locking provisions, Factory applied finish in ANSI #61 Medium Light Grey. UL listed acrylic baked paint finish over a rust-inhibiting, corrosion-resistant primer on treated metal surface.

- C. Station shall have auxiliary contacts for remote monitoring of switch position and contacts for connection of engine start signal wiring (field wired to associated A.T.S. by E.C.).
- D. Station shall have provisions for Camlock cable connections. Spring-loaded or latching hinged flap for cable entry.
- E. Where switch utilizes manual, double-throw action to transfer load, means shall be available to padlock switch in all positions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wall Mounted Switch: Utilize appropriate brackets or inserts.
- B. Floor Mounted Switch: Anchor to concrete base by bolting.
 - 1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Identify components according to Division 26 Section "Identification for Electrical Systems."
- D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Connect automatic transfer switch(es) to initiate cranking of the emergency generator and to provide remote indication where specified or indicated on the drawings. Include installation of all wire and conduit associated with each automatic transfer switch.
 - 2. Connect automatic transfer switch to signal elevator (if connected to emergency/standby system).

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Coordinate tests with tests of generator and run them concurrently.

- C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Arc Flash Evaluation Studies are required to be made by the distribution switchgear manufacturer. The Electrical Contractor shall provide the appropriate labels to the automatic transfer switch(es).

3.4 WARRANTY

- A. Provide 5-year extended warranty (Parts and Labor). Provide the certificate directly to the Owner accompanied by a letter of transmittal. Provide a copy to the Architect/Engineer with shop drawings.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switch(es) and related emergency standby equipment.

END OF SECTION 263601

SECTION 26 4113 - LIGHTNING PROTECTION FOR NEW BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section defines work for a complete system of lightning protection for a new building, consisting of points, connectors, conductors and driven ground rods. System shall be provided for the total building, including all exhaust fans, mechanical equipment, pipe stacks, etc., protruding from the roof.

1.2 SUBMITTALS

- A. Product Data: For air terminals and mounting accessories indicated.
- B. Shop Drawings: Detail lightning protection system, including air-terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway and data on how concealment requirements will be met for down conductors, etc.
- C. Qualification data.
- D. Certification, signed by Contractor, that roof adhesive for air terminals is approved by manufacturers of both the terminal assembly and the roofing material.
- E. Field inspection reports indicating compliance with specified requirements.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is NRTL listed or who is certified by LPI as a Master Installer/Designer.
- B. Listing and Labeling: As defined in NFPA 780, "Definitions" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Maxwell Lightning Protection Co..
 - 2. AC/ERICO International Corporation.
 - 3. Harger Lightning & Grounding
 - 4. Independent Protection Co.
 - 5. Robbins Lightning Inc.

2.2 LIGHTNING PROTECTION SYSTEM COMPONENTS

- A. Comply with UL 96.
- B. Roof-Mounting Air Terminals: Minimum 0.50" x 18" solid aluminum blunt points (complying with OSHA requirements) on building (and penthouse) roofs, high points and corners..
- C. All material shall be aluminum and shall be UL labeled. Where roof flashing or other roofing materials are not compatible with aluminum, the air terminals and conductors on the roof shall be of compatible materials.
- D. Provide aluminum connecting and down conductors and approved Copperweld grounding rods.
- E. Utilize approved and listed connectors and devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lightning protection components and systems according to UL 96A and NFPA 780.
- B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.
- C. Conceal the following conductors within the structure of new construction utilizing Schedule 40 PVC:
 - 1. System conductors.
 - 2. Down conductors.
 - 3. Interior conductors.
 - 4. Conductors within normal view from exterior locations at grade within 200 feet of building.
 - 5. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.
- D. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.
- E. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.
- F. Bond extremities of vertical metal bodies exceeding 60 feet in length to lightning protection components.
- G. A counterpoise installation based on requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" may be used as a ground loop required by NFPA 780, provided counterpoise conductor meets or exceeds minimum requirements in NFPA 780.
 - 1. Bond ground terminals to counterpoise conductor.

2. Bond grounded metal bodies on building within 6 feet of ground to counterpoise conductor.
- H. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot intervals.
- I. Bond to the water system where the water supply enters the building.
- J. Install surge arresters on the electric service when not included elsewhere in the specs. Refer to Section 26 4313 for type and manufacturers.
- K. Provide necessary common grounds between the lightning protection system and the electric and telephone/data service entrance wires, TV and radio antenna grounds.
- L. All connections to driven ground rods or other earth electrodes shall utilize exothermic weld connections and shall be located a minimum of three feet from the foundation wall or beyond the roof drip line (whichever is greater) and at least one foot below grade.
- M. Allow for furnishing and installing 4 additional down conductors above the Code required quantity to enable better concealment of conductors.

3.2 CORROSION PROTECTION

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.
- B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.3 FIELD QUALITY CONTROL

- A. UL Inspection: Provide inspections as required to obtain a UL Master Label for system.
- B. Provide an inspection by an inspector certified by LPI to obtain an LPI certification.

END OF SECTION 26 4113

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SECTION 26 4313 – SURGE PROTECTIVE DEVICES (SPD) FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes SPD's for low-voltage power equipment.

1.2 QUALITY ASSURANCE

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer. Manufacturer shall have been engaged in the manufacture of SPD products specified and products shall have been in satisfactory service for not less than 5 years.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- D. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- E. Comply with UL 1283 5th Edition, "Electromagnetic Interference Filters," and UL 1449 3rd Edition, "Surge Protective Devices."

1.3 PROJECT CONDITIONS

- A. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: 30 to 120 deg F.
 - 3. Humidity: 0 to 85 percent, non-condensing.
 - 4. Altitude: Less than 20,000 feet above sea level.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advanced Protection Technologies, Inc. (ASCO)
2. Current Technology, Inc. (ABB)
3. Cutler-Hammer, Inc. (Clipper)
4. Liebert Corporation.
5. Thor Systems, Inc.
6. Siemens Energy & Automation, Inc.
7. Square D.
8. General Electric (GE).
9. LEA International.

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. Fuses/circuit breaker, rated at 200-kA interrupting capacity.
 4. Integral disconnect switch or circuit breaker to isolate entire suppressor components for repair/replacement.
 5. Redundant suppression circuits.
 6. Surge-event operations counter.
- B. Peak Single-Impulse Surge Current Rating: 150kA per mode (300 kA per phase).
- C. Connection Means: Permanently wired.
- D. SPD and overcurrent/disconnect device shall have a short circuit current rating greater than that available on the electrical system.
- E. Protection modes and UL 1449 voltage protection rating compatible with system voltage and configuration as indicated on the drawings for complete protection as follows:
1. Line to Neutral.
 2. Line to Ground.
 3. Neutral to Ground.

2.3 PANELBOARD SUPPRESSORS

- A. Same characteristics and requirements as service entrance suppressors with the following exceptions:
- B. Surge-event operations counter not required.
- C. Peak Single-Impulse Surge Current Rating: 65kA per mode (130 kA per phase).

2.4 ENCLOSURES

- A. NEMA 250 (or better), with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible (not to exceed 18 inches). Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground. Twist input conductors together to reduce system inductance.
 - 1. Provide multipole circuit breaker or fusible disconnect switch as a dedicated disconnect for suppressor, fuse size and type as recommended by SPD manufacturer.

3.2 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect service equipment to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

- A. Testing: Perform the following field tests and inspections and document on test reports:
 - 1. Complete startup checks according to manufacturer's written instructions.

END OF SECTION 26 4313

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SECTION 26 5113 - INTERIOR LIGHTING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures, light engines (LED's) and drivers.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. See Division 26 Section "Wiring Devices" for manual wall-box dimmers for LED fixtures or lamps.
- C. See Division 26 Section "Lighting Control Devices" for automatic control of lighting, including occupancy sensors, and multi-pole lighting relays and contactors.

1.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes and photometric data.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
- C. LED Fixtures: Fixtures with LED light source are noted on lighting fixture schedule with advertised lumen output of light source for fixture/manufacture specified and color temperature. Listed equal manufacturer shall provide fixture with equivalent lumen output as listed product. If insufficient information is provided, the Engineer may require Project Specific, point-by-point photometric calculations of sample areas utilizing the submitted fixture to prove equivalent performance.
- D. Product Certificates: For each type of driver, signed by product manufacturer.
- E. Utility Company Energy Rebate Programs
 - 1. LED lighting fixtures shall be Energy Star or DLC listed to comply with local Utility Company Rebate Programs. Does not apply to track lighting fixtures. Fixture submittals that do not have either of these listings clearly indicated in the product data shall be rejected.
- F. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. All LED fixtures and components shall be tested and comply under the standards of IESNA LM-79-08, LM-80-08, LM-82-12 and TM-21-11 for measurement and publication of projected long term lumen maintenance, color stability, photometric performance and LED source operating lifetime. Fixture submitted shall meet the listed lifetime rating of the fixture specified, as a minimum.

1.4 WARRANTY

- A. Provide a written, five year replacement material warranty for defective or non-starting LED source assemblies. Warranty period shall begin on date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In Lighting Fixture Schedule the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified on drawing schedule.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with UL 1598 and NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Polymer Components: Plastic or polymer housing/components of fixture assemblies shall be rated for the temperature (or plenum) environment installed and shall not degrade in structural integrity, shape, color or finish for a minimum of 10 years.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit servicing without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during servicing and when secured in operating position.
- F. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

- a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
 - b. UV stabilized.
2. Glass: Tempered glass, unless otherwise indicated.
- G. Servicing Access: Fixtures specified for installation in inaccessible (gypsum/drywall) ceilings/walls, etc. shall be fully serviceable/accessible from the fixture aperture.
- H. Disconnecting Means:
1. Lighting fixtures with luminaires that utilize fluorescent double-ended lamps and contain ballast(s) that can be serviced in place or ballasted luminaires that are supplied from multi-wire branch circuits and can be serviced in place shall have a local disconnecting means at/within the fixture complying with NEC Article 410.130(G).

2.3 DRIVERS

- A. Drivers for LED Light Sources:
1. Driver shall be separate component from LED light source and shall be replaceable utilizing mounting screws, factory provided clips and electrical connector bodies.
 2. Dimming (When noted or indicated on Fixture Schedule): 100 to 1 percent of rated lumens via separate 0-10V input (Dimmer) control. Line voltage dimming acceptable when noted on plans.
 3. Level Control/Step-Dimming (When noted or indicated on Fixture Schedule): Minimum capability of bi-level control (100%-50%-Off) or 1/3-2/3-Full on, as noted.
 4. Voltage input: 120-277 Volt multi-volt capability.
- B. Internal-Type Emergency Fluorescent Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with driver. Comply with UL 924.
1. Emergency Connection: Operate light source continuously at a minimum output of 1000 lumens. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture driver.
 2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 5. Voltage input: 120-277 Volt multi-volt capability.

- C. Where plans call for multi-level switching/lighting, provide appropriate driver in fixture as required to accommodate the switching level arrangement of fixture.

2.4 EXIT SIGNS

- A. Internally Lighted Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
 - 1. Light source for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
 - 2. Voltage input: 120-277 Volt multi-volt capability.

2.5 EMERGENCY LIGHTING UNITS

- A. Description: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns luminaire on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Luminaire automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects luminaire from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6. Voltage input: 120-277 Volt multi-volt capability.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge.
- C. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- D. Recessed fixtures shall be supported at all 4 corners, independent of each other, from structure above with steel #12 single jack chains. Additionally, securely fasten each fixture to the ceiling framing member by mechanical means such as bolts, screws, rivets or approved clips; install a minimum of one on each four sides of fixture.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls.

- B. Comply with NFPA 70 for minimum fixture supports.
- C. Suspended Lighting Fixture Support:
 - 1. Single or Continuous Rows: Provide manufacturer required quantity of suspension cables at minimum intervals to support continuous row fixtures. The E.C. shall support suspended fixtures independently from the ceiling system and as specified by the fixture manufacturer.
- D. Surface or Flush Lighting Fixture Support:
 - 1. The E.C. shall coordinate fixture locations with the trade installing the ceiling system to assure support members are oriented and located to accommodate the lighting fixture layout.
 - 2. Surface or flush fluorescent fixtures in ceilings of the suspended lay-in type shall be installed so that the long dimension of the fixture is supported on the main support members of the ceiling system.
- E. Luminaires installed in exposed or concealed locations under metal corrugated sheet roof decking shall be installed and supported so there is not less than 1-1/2" measured from the lowest surface of the roof decking to the top of the luminaire.
- F. Adjust aimable lighting fixtures to provide required light intensities.
- G. Where fixtures are suspended in Mechanical/Electrical/Storage/Technology or Utility spaces with no suspended ceiling, coordinate mounting heights and locations with exposed ductwork, piping, conduit/data cabling racks, equipment, etc. to provide optimal and even light distribution to service equipment.
- H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Where applicable, verify transfer from normal power to battery and retransfer to normal.

3.3 SPARE LAMPS/FIXTURES

- A. For LED fixtures with LED source integral to the fixture assembly, provide one spare fixture for each type as noted on lighting fixture schedule.
- B. For fixtures with separate/replaceable LED luminaire (retrofit lamp), provide 5 spare lamps of each type utilized.

END OF SECTION 26 5113

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SECTION 26 5200 – EXIT AND EMERGENCY LIGHTING

PART 1 - GENERAL

- 1.1 Exit lighting and emergency lighting system wiring shall be run in conduit system which is completely independent of normal wiring systems.

PART 2 - PRODUCTS – N/A

PART 3 - EXECUTION

- 3.1 Install a green ground wire throughout the wiring system.

END OF SECTION 26 5200

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SECTION 26 5600 – EXTERIOR AREA LIGHTING

PART 1 - GENERAL

- 1.1 Work includes complete new exterior lighting including luminaires, lamps, poles, bases, conduit, conductors, fusing, control devices, etc. as shown on the drawings. Include all excavation, backfill, concrete bases and encasement of underground conduits as detailed on the drawings.

PART 2 - PRODUCTS

- 2.1 Refer to data on the drawings for fixture details.
- 2.2 Aluminum poles, when specified, shall include a vibration dampener provided by the manufacturer.
- 2.3 Exterior building mounted lights utilized for emergency egress shall incorporate multiple drivers/LED sources where a single fixture is utilized at an exterior exit.

PART 3 - EXECUTION

- 3.1 Concrete bases for standards shall be round extending above finish grade as detailed on the drawings with rounded corners and rubbed finish. Furnish anchor bolts as recommended by the manufacturer. Concrete bases shall be poured-in-place at the job site; steel reinforced concrete, minimum 3500 lb. test.
- 3.2 Provide a surge arrester behind the handhole in pole base of each lighting standard and connect to each phase conductor and 0.625" diameter by 10 ft. long copper clad driven ground rod providing a good grounding path. Connect the equipment grounding conductor to this grounding terminal. A separate ground rod is required for each lighting standard exceeding 15 ft. in height. Surge arresters shall be Square D Series SDSA, Joslyn Model Series 1250 or G.E. 9L15E and F Series. Install per NEC Article 280.
- 3.3 Provide Buss "KTK" fuses in HEB waterproof in-line holder ahead of the ballast in each "hot" leg; locate behind handhole in pole base.
- 3.4 Consult manufacturer of pole and fixture(s) for recommended installation methods.
- 3.5 Mount standards truly vertical. Shim and grout under fixture base to level standards, visible shims are not acceptable. Provide anchor bolt covers.
- 3.6 Splicing shall be made with approved and UL Listed, waterproof splicing kits and shall be located in base of poles behind handhole or in splice box if indicated on plans.

- 3.7 Install a green ground wire throughout the underground wiring system and bond to all standards.

END OF SECTION 26 5600

SECTION 26 6101 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers fire alarm systems, including initiating devices, notification appliances, controls and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment and materials for installation of the fire alarm system as indicated on the drawings and specifications.
- C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
 - 1. Fire alarm and detection operations.
 - 2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, fire suppression systems, emergency power systems and other equipment as indicated in the drawings and specifications.

1.2 Acceptable Manufacturer

- A. Manufacturer: The equipment and service described in this specification are those of the existing building fire alarm system supported by Notifier, whose catalog numbers are used herein for establishing equipment criteria. The system vendor responsible for servicing and maintaining the existing fire alarm system shall be utilized for all fire alarm system modifications and obtaining system design, permitting and approval by the AHJ (Ohio Valley Integration Services, OVIS. Contact Gordon Butler (937) 492-0088).

1.3 Related Documents

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 1 and 26 Specification Sections, apply to this section.
- B. The work covered in this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
 - 1. Division 26: "Common Work Results for Electrical."
 - 2. Division 26: "Control Voltage Electrical Power Cables."
- C. The system and all associated operations shall be in accordance with the following:
 - 1. Guidelines of the following Building Code: BOCA
 - 2. NFPA 72, National Fire Alarm Code
 - 3. NFPA 70, National Electrical Code
 - 4. NFPA 101, Life Safety Code
 - 5. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems

6. Other applicable NFPA standards
7. Local Jurisdictional Adopted Codes and Standards
8. ADA Accessibility Guidelines

1.4 System Description

- A. System is a microprocessor based, double supervised, closed circuit fire alarm system of modular design utilizing addressable technology for remote devices. Wiring shall be Class “B” for signaling and notification circuits. Smoke detectors shall be analog, addressable units with control panel adjustable sensitivity. All equipment shall be labeled by U.L. for fire alarm signaling use.
- B. Operation of any addressable manual or automatic fire alarm initiating device shall initiate the following:
 1. Sound a Code-3 temporal pattern audible alarm signal (pattern programmable at the main panel) and illuminate fire signal lights (strobes) in a synchronous mode until alarms have been silenced. Alarm may be silenced at the main fire alarm system control panel or at a remote annunciator panel by means of an “alarm silence” switch or if the initiating device returns to normal and a system “reset” switch is manually actuated.
 2. Display the alarm condition on integral LCD display in the main control panel and remote annunciator(s). Display shall indicate the alarming device and its location. All alarm initiating devices shall be individually addressed.
 3. Print the assigned message with time and date at the control panel (or remote printer, if specified). Activate control-by-event functions listed in these specifications.
 4. Initiate a separate trouble and alarm signal for connection to remote monitoring service organization via dedicated telephone line(s) or as directed by Owner.
 5. Release all electromagnetic door holders.
- C. Elevator Fire Service Mode Controls
 1. Alarm condition from any associated elevator machine room smoke detector(s) shall initiate control signals for primary and alternate elevator recall. Provide programmable relays located in the elevator machine room to perform these functions. Alarm condition from any non-primary egress level elevator lobby (or top or bottom of elevator shaft) smoke detector, shall initiate the primary recall function. Alarm condition from the primary egress level elevator lobby (or elevator machine room) smoke detector shall initiate the alternate recall function. The smoke detectors for elevator recall service shall conform to NFPA 72 and ANSI A17.1.
 2. Alarm condition from smoke detector(s) in the elevator machine room, bottom of elevator shaft or at the top of the elevator shaft shall initiate a control signal for fireman’s elevator alert operation. Provide programmable relay in elevator machine room to perform this function.
 3. Alarm condition from heat detector(s) (located adjacent to fire suppression sprinkler head(s)) in elevator machine room, bottom of elevator shaft or at the top of the elevator

shaft (if applicable) shall initiate a control signal to activate the elevator power shunt-trip. Provide programmable relay adjacent to elevator power module in machine room to perform this function.

4. Upon loss of voltage to the control circuit for the elevator shunt-trip device, initiate a supervisory trouble signal to the main control panel and remote annunciator(s). Provide a programmable monitoring module adjacent to elevator power module in machine room to perform this function.
 5. For each elevator (or elevator group), provide required interface modules in NEMA 1 enclosure within 3 feet of the elevator controller for connections for fire emergency service mode operations. Extend control wiring from relays to each controller for final connection to controller by the Elevator Contractor. Extend #12 AWG wiring to the shunt-trip breaker and control voltage sensing in the elevator machine room. Coordinate all control wiring requirements with the Elevator Contractor prior to rough-in.
- D. In the event of an operating power failure or an open or a grounded circuit in the system, a trouble signal and a trouble light shall be activated until the problem is corrected and the system is restored to normal. The trouble event shall be recorded in the system history log and printed on the system printer (when applicable). The trouble may be silenced by means of a button on the main control panel. Upon restoration of the system to a normal condition, the trouble light shall extinguish.

1.5 Submittals

- A. General: Submit one electronic set (in pdf format) of the following to the Architect/Engineer for review for conformance with the Bid Documents prior to submission to the AHJ for permit:
1. Product data sheets for system components highlighted or marked to indicate the specific products, features or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds or does not comply with this specification.
 2. Wiring diagrams from Manufacturer's Vendor.
 3. Shop drawings showing system details including location of FACP, all devices, circuiting and details.
 4. System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
 5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, NAC, relay, sensor and auxiliary control circuits.
 6. Operating instructions for FACP.
 7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type of product, including all features and operating sequences, both automatic and manual. Provide the names, addresses and telephone numbers of service organizations.
 8. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with specified requirements.

- B. Submission to Authority Having Jurisdiction: After Architect/Engineer review of routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make re-submissions if required to make clarifications or revisions to obtain approval.

1.6 Quality Assurance

- A. Installer Qualifications: Installer(s) shall meet State of Ohio and local Municipality requirements for certification and as a minimum, have one installer certified as a NICET Level 2. In addition, the fire alarm system supplier shall have on staff, one NICET Level 3 certified individual and be an UL certified company.
- B. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by UL Inc. and shall bear the UL label.

1.7 Extra Materials

- A. General: Furnish extra materials, packaged with protective covering for storage and identified with labels clearly describing contents as follows:
 - 1. Strobe units: Furnish four (4) units, plus 50 ft. of wire for each device, installed at the Engineer's direction.
 - 2. Horn/Strobe units: Furnish four (4) units, plus 50 ft. of wire for each device, installed at the Engineer's direction.
 - 3. Smoke Detectors or Sensors: Furnish two (2) units.
 - 4. Detector or Sensor Base(s): Furnish two (2) units of each type installed, plus 50 ft. of wire for each, installed at the Engineer's direction.
 - 5. Pull station(s): Furnish four (4) units, plus 50 ft. of wire for each device, installed at the Engineer's direction.
 - 6. Addressable Circuit Interface Modules: Furnish two (2) units, plus 50 ft. of wire for each, installed at the Engineer's direction.

PART 2 - PRODUCTS

2.1 Control Unit

- A. Control unit shall contain all necessary components to provide complete control, testing and indicating facilities for the entire fire alarm system. Relays, where utilized, shall be pluggable type, sealed in dustproof containers to prevent failure from dust, dirt, tampering and accidental contact. Unit shall facilitate silencing of alarm from one addressable device and shall resound on subsequent alarm from another addressable device. Unit shall be double supervised, individually annunciated by addressable point with the following features: test switch, silencing switch(es), reset switch(es), control switch(es), power "on" lamp, minimum of 80 character LCD display, "Alarm" lamp and a means to simultaneously test all indicator lamps (LED's). "Trouble" signal shall be in integrally mounted alert signal with a SPL of 80 db at 4 ft. Trouble alarm silence switch (button) shall have ring back feature.

- B. An alarm shall be displayed on a two line, minimum 80 character LCD display. Display shall indicate alarms, supervisory service conditions and any trouble conditions. The top line of characters shall be the address/point label and the second line shall be the device type identifier. The system ALARM red LED shall flash on the main control panel and remote annunciator panels until the alarm has been acknowledged at any of the panels. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another point, after acknowledged, shall flash the system ALARM red LED on the control panels. The LCD display shall show the new alarm information. A pulsing alarm tone shall occur within the control panel and the remote annunciator panels until the alarm is acknowledged.
- C. The control panel shall be sized to accommodate 250 addressable devices, expandable to 2000 addresses thru the addition of Idnet card(s) within this control panel. Power supplies shall be supplied with 100% capacity including provisions for 20% additional strobe lights and 20% additional audible devices. Provisions for spare capacity shall include additional data loop cards or signaling cards to support the specified capacity. Audible signals shall be master controlled from the fire alarm panel or permit master coded signaling in a Code-3 temporal pattern, panel selectable without making any modifications to remote devices. All visual alarm signals (strobe lights) shall be synchronized at the fire alarm panel. Notifier NFS2-3030 series with all necessary accessories.
- D. Cabinet shall be modular construction, shall be semi-flush mounted and shall accommodate all modules, cards, relays, terminal connections, batteries, etc., necessary for system operation. The outer door and frame assembly shall be equipped with a keyed lock and shall have a transparent door panel to enable viewing all alarm and trouble lights, as well as LCD display, without opening door. Provide manufacturer's standard enamel finish.
- E. The control panel shall communicate individually with addressable initiating and control devices. Each device shall be individually annunciated at control panel.
 - 1. Annunciation shall include the following:
 - a. Alarm
 - b. Trouble
 - c. Open
 - d. Short
 - e. Device missing/failed
 - 2. All addressable devices shall be capable of being disabled or enabled individually.
 - 3. Smoke detectors shall utilize "Alarm Verification" operation.
 - 4. Smoke sensor sensitivity shall be field-adjustable from the control panel for the analog style detectors. Control panel shall have a self-test function such that each sensor is automatically tested once every 24 hours. Sensor shall notify control panel when maintenance is required. System shall automatically compensate for variations in environmental conditions.
- F. The control panel shall have a "Walk Test" feature.
- G. Operating power shall be supplied from a 120 volt, 60 Hz circuit while the supervisory power shall be supplied from an integral DC power supply. The low voltage DC power shall consist of power limited, filtered and regulated power supplies with maintenance-free, lead-calcium battery back-up with automatic recharger. Indication for normal power supply and power supply trouble shall be provided. Provide remote cabinet for batteries where size dictates need. Batteries shall be sized to maintain system operation, including trouble alarm, for 24 hours with

sufficient reserve capacity to power all alarm sounding devices for 5 minutes. Battery capacities shall be sized to include provisions for the spare strobe light and audible devices in Para. 1.7. Door holders are not required to be maintained by the standby batteries. All batteries shall be supervised.

- H. Provide surge suppressors ahead of all 120 volt power connections to the fire alarm equipment. Locate suppressors within equipment enclosure or in a junction box directly above/adjacent to the unit. These suppressors are in addition to internal protection provided with the fire alarm system's internal electronics.
- I. Provide surge suppressors on all initiating and notification circuits that enter or leave the building to/from remote locations.

2.2 Remote System Components

- A. Miniplex transponders will communicate with the Main Fire Alarm Control Unit to provide for centralized control of alarm and trouble signaling as well as output signaling. The transponder shall be capable of limited stand-alone operation in the event the communication link to the central system is lost. Each transponder shall be furnished with all necessary controls, power supplies and battery back-up.
- B. Manual stations shall be addressable communicating devices, shall be non-coded, single action with break rod operation (glass rod not required to reset station), red finish semi-flush mounted with keyed reset switch. Notifier #NBG-12LX.
- C. Fire signal lights (strobe lights) for synchronized operation shall provide visual indication of all alarms and shall illuminate in a flashing mode whenever system is in alarm state. Fire signal lights shall be labeled in accordance with UL 1971 Standards and shall be 15 candela in corridors and 110 candela in all other areas unless specifically designated otherwise. Semi-flush mount signal lights on walls where shown on the drawings. Lens shall be installed in a horizontal alignment on a red back plate labeled "FIRE" and shall produce one flash per second. Strobes shall be System Sensor L Series. Exterior units shall be gasketed and labeled for exterior use, System Sensor SpectraAlert series UL 1638 compliant).
- D. Horns shall be semi-flush mounted, with red grille and field selectable output levels of 85 or 91 dB at 10 ft. (based on UL 464 reverberant test requirements). Horn operating power levels shall be set initially at 85 dB and adjusted upward as required for proper sound coverage during the final check-out. Power calculations shall be made using the current draw for all units operating at 91 dB. Outside assemblies shall be weatherproof. Combination (audible/visible) horn and fire signal lights shall utilize a compact, combination mounting base assembly. Horns shall be labeled "FIRE". System Sensor L Series (utilize the continuous horn signal setting) with mounting accessories. Exterior units shall be gasketed for weatherproof rating. Combination strobe/horn signal units shall be factory assembled, System Sensor L Series.
- E. Combo horns with fire signal lights (strobe lights) for synchronized operation shall provide both audible and visual indication of all alarms and shall illuminate in a flashing mode whenever system is in alarm state. Fire signal lights shall be labeled in accordance with UL 1971 Standards and shall be 15 candela in corridors and 110 candela in all other areas unless specifically designated otherwise. Semi-flush mount horn/signal lights on walls where shown on the drawings. Lens shall be installed in a horizontal alignment on a red back plate labeled "FIRE" and shall produce one flash per second. Horns shall have a red grille with field

selectable output levels of 85 or 91 dB at 10 ft. (based on UL 464 reverberant test requirements). Horn operating power levels shall be set initially at 85 dB and adjusted upward as required for proper sound coverage during the final check-out. Power calculations shall be made using the current draw for all units operating at 91 dB. All strobes shall be synchronized throughout the entire building utilizing control circuitry within the main fire alarm panel (and extender panels, if used). Exterior units shall be gasketed and labeled for exterior use, System Sensor L Series.

- F. Surface mounted fire alarm devices mounted on walls-such as manual stations, horns, strobes, etc. shall utilize finished backboxes. These backboxes shall be red metal and shall be field punched for conduit entrance (boxes shall not be stamped KO construction).
- G. Individual addressable monitor module shall be an addressable module used for monitoring N.O. contact devices such as water flow, tamper switches, kitchen hood ansul system, elevator shunt-trip power monitor, etc. Notifier #FMM-101.
- H. Programmable relay control module shall be an individual addressable module used for control of auxiliary functions such as elevator control, door release, smoke damper shutdown, air handling unit shutdown, etc. Notifier #FRM-1.
- I. Photo-electric type, addressable, ceiling mounted smoke detectors, shall utilize all solid state components operating on the light scatter principle and shall have adjustable sensitivity set at the transponder to detect smoke at 0.5% to 3.7% light obscuration per foot. The sensors shall communicate actual smoke chamber sensitivity to the system control where it is constantly monitored. Each addressable detector is individual adjustable thru the control panel and environmentally adjusted. The system will indicate when individual sensors need cleaning. Detector head shall have a white finish and contain an integrally mounted LED pilot lamp that indicates detector status. Notifier #FSP-951 with B300 base. Provide remote LED alarm indicators when indicated on plans.
- J. Photo-electric type, addressable, duct mounted smoke detectors, shall utilize all solid state components operating on the light scatter principle and shall have adjustable sensitivity set at the transponder to detect smoke at 0.5% to 3.7% light obscuration per foot. The sensors shall communicate actual smoke chamber sensitivity to the system control where it is constantly monitored. Each addressable detector is individual adjustable thru the control panel and environmentally adjusted. The system will indicate when individual sensors need cleaning. Detector head shall have a white finish and contain an integrally mounted LED pilot lamp that indicates detector status. Notifier #DNR/FSP-951/DST/FRM-1. A remote LED "status" light shall be flush mounted at 54" mounting height in a convenient location within sight of air handling unit, Notifier #RA-400Z.
- K. Smoke detectors for elevator lobbies, elevator shafts and elevator machine rooms shall be **addressable**, 2-wire photo-electric smoke detectors suitable for ceiling or wall mounting. Detectors shall utilize all solid state components operating on the light scatter principle and shall be factory set to detect smoke at a 2% light obscuration per foot. Detector shall have a 30-mesh insert screen, completely closed backs and shielded electronics to minimize false alarms from dust, insects, EMI or RFI. Detectors at the top of elevator shafts shall be installed with a remote test switch at an accessible location.
- L. Ceiling mounted heat detectors shall be addressable, combination rate-of-rise and fixed temperature type set to alarm at 135 degrees F. or on a temperature rise of 15 degrees F. per

minute. Unit shall be capable of low temperature monitoring. Detector shall be white and low profile style, Notifier #FST-951 with #B300 base.

- M. Waterflow switches shall indicate the continuous flow of water in sprinkler pipes where indicated on drawings. Unit shall be equipped with retard mechanism, adjustable up to two minutes, to minimize false alarms due to pressure changes. Retard mechanism and allowable time delay shall be subject to local AHJ requirements. Unit shall be supplied and installed by the Fire Suppression Contractor and wired to the fire alarm system by the E.C. via a monitor module with a dedicated address.
- N. Gate valve switches (OS&Y) shall monitor the status of sprinkler valves where indicated on drawings and shall signal a trouble alarm when respective valve is closed. Unit shall be supplied and installed by the Fire Suppression Contractor. Each gate valve switch shall be wired to the fire alarm system by the E.C. via a monitor module with a dedicated address.
- O. Magnetic door holders shall be multi-voltage selectable for 24 VDC or 24/120VAC operation. Flush wall mounted, Notifier #FM-998; semi-flush mounted, Notifier #FM-997 for new construction or surface wall mounted, Notifier #FM-996 for remodel applications on existing walls. Floor mount models for single door, Notifier #FM-980 or double door, two Notifier #FM-980, where shown on plans or application requires such use.
- P. Remote Annunciator and Operator Control Panels shall be flush wall mounted where shown on plans. Each shall consist of an 80 character LCD display with control features similar in appearance and orientation as the main fire alarm control panel. Control buttons shall be locked behind a window (keyed the same as the main fire alarm control panel) to prevent unauthorized operation.
- Q. Notification appliance power extender control panels shall be provided where shown on the drawings. These panels shall communicate with and be completely supervised from the main fire alarm control panel. They shall be capable of powering additional synchronized visual alarm signals (strobes) and/or audible alarm signal circuits. Each panel shall include supervisory modules, power supplies, batteries and chargers. At the Contractor's option, additional extender panels may be utilized if deemed acceptable by and locations are coordinated with the Architect/Engineer during the bidding phase. Notifier #FCPS-24 Series panel with accessories.
- R. A digital communicator shall be located within the main fire alarm control panel to automatically transmit designated alarms, supervisory and trouble signals to a central station monitoring service via dedicated telephone lines. The digital communicator shall be connected to one telephone line and a cellular dialer, shall supervise both means of communication and shall be capable of sending alarm signals on both means of communications to the Central Monitoring Service. The fire alarm panel shall indicate a trouble alarm on any digital communicator equipment failure (including loss of telephone line connection for longer than 45 seconds). The digital and cellular dialer shall be powered and maintained by the main fire alarm control panel standby battery power supply. Provide surge suppression on the 120 volt power supply and on one telephone lines. Provide both digital and cellular dialers and one year of UL monitoring.

The digital communicator shall transmit the following event level information:

1. Fire Alarm Condition
2. Supervisory Condition
3. Trouble Condition

4. Daily Test Signal

- S. Provide a recessed Knox-Box rapid entry system where indicated on drawings. Extend wiring from the Knox-Box tamper switch to a monitor module to signal a trouble to the building fire alarm system.

PART 3 - EXECUTION

3.1 Installation, General

- A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

3.2 Equipment Installation

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes and all other necessary material for a complete operating system. Wall mounted devices shall utilize manufacturer recommended rough-in boxes with bushed conduit stubbed above accessible ceiling (as a minimum).
- B. If the building has a legally required standby power generator or power system, the E.C. shall provide a 20 Amp-120 Volt emergency circuit from the nearest Life-Safety emergency panel to the main fire alarm panel and any additional Notification Appliance (Power Extender) Panels required by the system.
- C. Coordinate door holder equipment connections and installation with door hardware supplier.
- D. Locate duct mounted smoke detectors per UL and manufacturer's guidelines for accurate air sampling and to permit easy access for maintenance and testing. Coordinate installation with the H.C. Where required, provide access panels. The E.C. shall ensure accessibility to the entire assembly.
- E. Provide a system smoke detector at the location of each fire alarm control unit (this includes the main panel and extender panels/auxiliary control panels where initiation/notification circuits originate).

3.3 Wiring Installation

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electrical Code (NEC).
- B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written

instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

- C. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuit wiring and a different color code for supervisory circuits. Color code notification appliance circuits differently from alarm initiating circuits. Paint fire alarm system junction boxes, conduit fittings and box covers red.
- D. The following wiring and conduit shall also be included in the fire alarm system work:
 - 1. Empty conduit with pull wire from the digital communicator to the main telephone backboard. Telephone wiring from the telephone backboard to the digital communicator is the Owner's responsibility (or provided under a separate contract). The E.C. shall assist in making the final connections at the digital communicator and verify transmission and receipt by the Central Station prior to final testing.
 - 2. From duct mounted smoke detector, control relay module or fire alarm panel to each air handling unit and exhaust fan for shutdown where required by OBC (606).
 - 3. For each elevator or elevator group:
 - a. Provide 2-#12 from the shunt-trip control relay module to the elevator shunt-trip breaker.
 - b. Provide 2-#12 from the elevator shunt-trip control voltage sensing to a monitoring module.
 - c. Provide 2-#14 from the fireman's hat indicator control relay module to the elevator controller for activation of the fireman's alert signal within the elevator cab.
 - d. Provide 2-#14 from the primary recall control relay module to the elevator controller (or group of controllers) for elevator "primary egress level" emergency service mode signaling.
 - e. Provide 2-#14 from the alternate recall control relay module to the elevator controller (or group of controllers) for elevator "alternate egress level" emergency service mode signaling.
 - f. Elevator emergency service mode signal wiring shall be from Form C dry contacts in each control relay in accordance with the elevator supplier's direction.
 - 4. From electro-mechanical door holders to associated smoke detectors and/or fire alarm panel or control relay.
 - 5. Wiring to supervisory monitor and control points.
- E. **Wire shall be installed in a separate and dedicated conduit system.**

3.4 Field Quality Control

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing and adjustment of the system.
- B. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing. Test the system according to the procedures outlined in NFPA 72.

- C. Report of Tests and Inspections: Provide a written record of inspections, tests and detailed test results in the form of a test log.
- D. Final Test, Certificate of Completion and Certificate of Occupancy:
 - 1. Test the system as required by the Authority Having Jurisdiction (AHJ) in order to obtain a certificate of occupancy.
- E. Revise all wiring diagrams and floor plans to reflect final accepted "As-built" conditions for the project and include in the O&M Manuals for the owner's use. In addition, the supplier shall include an electronic copy of the system's operating program on a CD.

3.5 Cleaning and Adjusting

- A. Cleaning: Remove paint splatters and other spots, dirt and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions, in compliance with NFPA 72. Provide up to three (3) visits to the site for this purpose.

3.6 Training

- A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's designated personnel for a minimum of 4 hours training on-site.

END OF SECTION 26 6101

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SECTION 313116 - TERMITE CONTROL

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. Soil treatment.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood preservative treatment by pressure process.

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. Include construction details, material descriptions, dimensions of individual components, and profiles for termite control products.
 - 2. Include the EPA-Registered Label for termiticide products.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each type of termite control product.
- C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.

2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

1.7 FIELD CONDITIONS

A. Soil Treatment:

1. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
2. Related Work: Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain termite control products from single source from single manufacturer.

2.2 SOIL TREATMENT

- A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.
 - 1. Manufacturers: Subject to compliance with requirements, :
 - a. Bayer Environmental Science
 - b. Syngenta Crop Protection, LLC
 - 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 - 1. Fit filling hose connected to water source at the site with a backflow preventer, according to requirements of authorities having jurisdiction.

3.3 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and

rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.

1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
 3. Masonry: Treat voids.
 4. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.
- B. Post warning signs in areas of application.
- C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.4 PROTECTION

- A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

END OF SECTION 313116