

JORDAN LEARNING CENTER
3706 W 9800 S
South Jordan, Utah 84009

FOR



BID NUMBER: 25KP03

PROJECT MANUAL

CONSTRUCTION DOCUMENTS

MHTN PROJECT NO 2024528

27 August 2024



vision made real

000107 - SEALS PAGE

DESIGN PROFESSIONALS OF RECORD

ARCHITECT	LANDSCAPE ARCHITECT	CIVIL ENGINEER
STRUCTURAL ENGINEER	ELECTRICAL ENGINEER	MECHANICAL ENGINEER

All professional seals (stamps) to be signed and dated; Architect Licensing Act Rules R156-3a, Utah Administrative Code, paragraph 601 and Professional Engineers Licensing Act Rules R156-22, Utah Administrative Code, paragraph 601.

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AIA[®] Document A701[™] – 2018

Instructions to Bidders

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

Sample

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

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

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ADDITIONS AND DELETIONS:

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

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

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

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

ARTICLE 1 DEFINITIONS

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

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

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

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

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

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

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

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

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

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

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

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.)

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

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

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

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

§ 3.2 Modification or Interpretation of Bidding Documents

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

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

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

§ 3.3 Substitutions

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

§ 3.3.2 Substitution Process

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

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

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

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

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

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

§ 3.4 Addenda

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

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

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

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

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

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

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

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

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

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

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

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

§ 4.2 Bid Security

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

(Insert the form and amount of bid security.)

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

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

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

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

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

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

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

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

§ 4.4 Modification or Withdrawal of Bid

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

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

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

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

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

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

§ 5.2 Rejection of Bids

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

§ 5.3 Acceptance of Bid (Award)

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

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

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

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

§ 6.2 Owner's Financial Capability

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

§ 6.3 Submittals

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

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

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

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

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

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

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

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

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

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

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

§ 7.2 Time of Delivery and Form of Bonds

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

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

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

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

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

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

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

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

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

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

- .5 Drawings

Number	Title	Date
.6	Specifications	

Section	Title	Date	Pages
.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.)

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

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

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Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, Kristine Larsen, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 17:57:55 ET on 02/12/2019 under Order No. 2583673677 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ – 2018, Instructions to Bidders , as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

(Title)

(Dated)



AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

BOND AMOUNT: \$**PROJECT:**

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

Sample

ADDITIONS AND DELETIONS:

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

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

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

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

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

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

Init.

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User Notes:

(1934915958)

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PAGE 1

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(Signed)

(Title)

(Dated)



AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

CONSTRUCTION CONTRACT

Date:

Amount: \$ 0.00

Description:

(Name and location)

Sample

BOND

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond: None See Section 16

CONTRACTOR AS PRINCIPAL

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:

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

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User Notes:

(791767595)

§ 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: _____



Init.

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PAGE 1

Amount: \$ 0.00

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Sample

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, Kristine Larsen, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 16:45:45 ET on 05/15/2019 under Order No. 2583673677 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A312™ – 2010, Performance Bond , as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

(Title)

(Dated)



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)

CONSTRUCTION CONTRACT

Date:

Amount: \$ 0.00

Description:

(Name and location)

Sample

BOND

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond: None See Section 18

CONTRACTOR AS PRINCIPAL

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:

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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

Company: _____ (Corporate Seal)

Signature: _____
Name and Title: _____
Address: _____

SURETY

Company: _____ (Corporate Seal)

Signature: _____
Name and Title: _____
Address: _____

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PAGE 1

Amount: \$ 0.00

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Sample

Certification of Document's Authenticity

AIA® Document D401™ – 2003

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(Signed)

(Title)

(Dated)

Application and Certificate for Payment

TO OWNER: PROJECT: sample 1 APPLICATION NO: 001 PERIOD TO: OWNER:

FROM CONTRACTOR: VIA ARCHITECT: CONTRACT FOR: General Construction ARCHITECT:

CONTRACT DATE: CONTRACTOR:

PROJECT NOS: / / FIELD:

OTHER:

CONTRACTOR'S APPLICATION FOR PAYMENT

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

1. ORIGINAL CONTRACT SUM \$ 0.00
2. Net change by Change Orders \$ 0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2) \$ 0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) \$ 0.00

5. RETAINAGE:

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

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

6. TOTAL EARNED LESS RETAINAGE \$ 0.00 (Line 4 Less Line 5 Total)
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT \$ 0.00 (Line 6 from prior Certificate)

8. CURRENT PAYMENT DUE \$ 0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6) \$ 0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	\$ 0.00	\$ 0.00
Total approved this Month	\$ 0.00	\$ 0.00
TOTALS	\$ 0.00	\$ 0.00
NET CHANGES by Change Order	\$	0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of: _____

County of: _____

Subscribed and sworn to before me this _____ day of _____

Notary Public: _____

My Commission expires: _____

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED \$ 0.00
(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

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

Continuation Sheet

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.
 In tabulations below, amounts are stated to the nearest dollar.
 Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO: 001

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO:

A ITEM NO.	B DESCRIPTION OF WORK	C SCHEDULED VALUE	D WORK COMPLETED		E THIS PERIOD	F MATERIALS PRESENTLY STORED (NOT IN D OR E)	G TOTAL COMPLETED AND STORED TO DATE (D+E+F)	H BALANCE TO FINISH (C - G)	I RETAINAGE (IF VARIABLE RATE)
			FROM PREVIOUS APPLICATION (D + E)						
		\$ 0.00	\$ 0.00		\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	GRAND TOTAL	\$ 0.00	\$ 0.00		\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00



AIA[®] Document A201[™] – 2017

General Conditions of the Contract for Construction

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

Sample

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

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ADDITIONS AND DELETIONS:

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

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

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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.

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§ 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.

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

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

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

§ 9.4 Certificates for Payment

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

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

§ 9.5 Decisions to Withhold Certification

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

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

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

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

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

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

§ 9.6 Progress Payments

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

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

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

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

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

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

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

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

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

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

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

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

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

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

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

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

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

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

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

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

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

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

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials and Substances

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

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

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

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

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

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

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

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

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

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

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

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

§ 11.2 Owner's Insurance

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

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

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

§ 11.3 Waivers of Subrogation

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

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

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

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

§11.5 Adjustment and Settlement of Insured Loss

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

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

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

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition.

During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during

that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

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

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

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

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

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

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

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

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

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

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

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

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

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

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

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

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

§ 14.3 Suspension by the Owner for Convenience

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

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

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

§ 14.4 Termination by the Owner for Convenience

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

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

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

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

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

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

§ 15.1.3 Notice of Claims

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

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost

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

§ 15.1.6 Claims for Additional Time

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

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

§ 15.1.7 Waiver of Claims for Consequential Damages

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

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

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

§ 15.2 Initial Decision

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

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

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

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

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

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

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

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

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

§ 15.3 Mediation

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

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

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

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

§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

Additions and Deletions Report for **AIA® Document A201™ – 2017**

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

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 16:48:07 ET on 05/15/2019.

PAGE 1

Sample

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, Kristine Larsen, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 16:48:07 ET on 05/15/2019 under Order No. 2583673677 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ – 2017, General Conditions of the Contract for Construction, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

(Title)

(Dated)

SUPPLEMENTARY CONDITIONS

The following supplements modify AIA Document A201–2017, General Conditions of the Contract for Construction. 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

§ 1.1.1 The Contract Documents

Delete Section 1.1.1 and substitute the following:

§ 1.1.1 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, the Contractor's bid or proposal, 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, or portions of Addenda relating to bidding or proposal requirements. The Contract also includes all final bid documents accepted by the School District. And the Bid document requirements.

§ 1.1.8 Initial Decision Maker

Delete Section 1.1.8 and substitute the following.

The Architect will serve as the Initial Decision Maker, and as such, is the person identified 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

Add Sections 1.2.1.2 through 1.2.1.4 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 Modifications.
- .2 The Agreement.
- .3 Addenda, with those of later date having precedence over those of earlier date.
- .4 The Supplementary Conditions.
- .5 The General Conditions of the Contract for Construction.
- .6 Division 1 of the Specifications.
- .7 Drawings and Divisions 2–49 of the Specifications.
- .8 Other documents specifically enumerated in the Agreement as part of the Contract Documents.

In the case of conflicts or discrepancies between Drawings and Divisions 2–49 of the Specifications, or within or among the Contract Documents and not clarified by Addendum, the Architect will determine which takes precedence in accordance with Sections 4.2.11, 4.2.12, and 4.2.13.

§ 1.2.1.3 Large scale drawings shall have precedence over small scale drawings in the same area or conditions and should any discrepancy occur between such large and small drawings the same shall be

referred to the Architect for decision or clarification. Minor modifications of detailed drawings may be made in larger or full-size drawings to clarify detail and to provide proper connection or construction at points not specifically detailed. Where a portion of the drawings or details is shown in outline, the portion shown in outline shall be constructed the same as like portions of work. If during the course of the contract, conflicts are found between the various parts of the drawings or between drawings and specifications, the Architect will interpret the drawings and/or specifications so as to secure the most substantial and complete performance of the work.

§ 1.2.1.4 Certain materials and equipment are specified by manufacturer or trade name to establish standards of quality and performance and not for the purpose of limiting competition. Products of other manufacturers may be substituted, if, in the opinion of the Owner and the Architect, they are equal to those specified in quality, performance, design and suitability for intended use. Where two or more items are mentioned, the selection among those specified is the Contractor's option. Bids based on material and equipment other than those specified shall include a statement of substitutions stating difference in cost, if any, for each proposed substitution. Substitutions accepted prior to award of the Contract will be covered by modification to the original Contract Documents. Prior to consideration of any substitution, the Architect may require submission of samples, descriptive, technical and catalog data and reports of tests.

Add Section 1.2.4 to Section 1.2.

§ 1.2.4 Notes and call-outs are to be representative of the complete scope of the project documents. Callouts made in one location apply to all similar conditions.

§ 1.7 Digital Data Use and Transmission

Replace the text under Section 1.7 with the following:

Release of Electronic Media Drawings and Files: an agreement entitled "License and Indemnification Agreement" must be signed and returned to the Architect prior to release of any Documents. A copy of the release is included in Division 1 Sections and may be obtained from the Architect.

ARTICLE 2 OWNER

§ 2.1 General

Replace the text under Section 2.1.1 with the following:

Because no entity may file liens against the Owner as a governmental entity, nothing herein shall be construed to grant a right to assert mechanic's liens against property of the Owner.

Delete Section 2.1.2.

§ 2.2 Evidence of the Owner's financial Arrangements

Delete Section 2.2.1.

§ 2.3 Information and Services Required of the Owner

Delete Section 2.3.6 and substitute the following:

§ 2.3.6 The Owner shall furnish the Contract Documents to the Contractor in digital format. If the Contractor requires paper documents, the Contractor shall be responsible for the costs of producing such paper documents.

ARTICLE 3 CONTRACTOR

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

Add Section 3.2.5 to Section 3.2:

§ 3.2.5 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for evaluating and responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents or where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

§ 3.3 Supervision and Construction Procedures

Replace the text under Section 3.3.3 with the following:

The Contractor shall be responsible for inspection of the work already performed to determine that such portions of work are in proper condition to receive subsequent work and to ensure that it complies with Contract Documents and relevant codes and authorities so that portions are in proper condition to receive subsequent work.

§ 3.4 Labor and Materials

Add Section 3.4.2.1 to Section 3.4.2:

§ 3.4.2.1 After the Contract has been executed, the Owner and Architect may consider requests for the substitution of products in place of those specified. The Owner and Architect may, but are not obligated to, consider only those substitution requests that are in full conformance with the conditions set forth in the General Requirements (Division 1 of the Specifications). By making requests for substitutions, the Contractor:

- .1 represents that it has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to the product specified;
- .2 represents that it will provide the same warranty for the substitution as it would have provided for the product specified;
- .3 certifies that the cost data presented is complete and includes all related costs for the substituted product and for Work that must be performed or changed as a result of the substitution, except for the Architect's redesign costs, and waives all claims for additional costs related to the substitution that subsequently become apparent;
- .4 agrees that it shall, if the substitution is approved, coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

Add Section 3.4.2.2 to Section 3.4.2:

§ 3.4.2.2 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect for reviewing the Contractor's proposed substitutions and making agreed-upon changes in the Drawings and Specifications resulting from such substitutions.

Add Section 3.4.4 to Section 3.4:

§ 3.4.4 The Contractor shall cooperate with the Architect in forwarding the interests of the Owner; he shall furnish efficient and skilled business administration and supervision during crucial periods along with an adequate supply of workers and materials, and shall complete the work in a workmanlike and expeditious manner, to the satisfaction of the Architect and Owner.

Add Section 3.4.5 to Section 3.4:

§ 3.4.5 The Contractor shall be responsible for storing, maintaining and preserving in a safe and

professional manner the materials that are delivered to the site prior to time for installation.

§ 3.6 Taxes

Replace the text under Section 3.6 with the following:

Purchases of construction materials by the Contractor is not subject to Utah State Sales Tax. Use of Tax-Exempt form TC-721g and authorization for such use shall be at the direction of the School District.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

Delete Section 3.7.1 and substitute the following:

§ 3.7.1 Unless otherwise notified in writing, the Contractor shall not be required to obtain Building Permits or other permits from governmental authorities. The Owner shall provide its own inspectors to comply with inspection requirements of governmental authorities. However, the fact that the Owner provides its own inspectors for such purposes does not release the Contractor from the obligation to conduct inspections of the Work to ensure that it complies with Contract Documents, or to otherwise comply with all applicable laws, statutes, ordinances, building codes, rules and regulations.

Add Sections 3.7.1.1 and 3.7.1.2 to Section 3.7.1:

§ 3.7.1.1 Fees for impact fees and permits for off-site work and roadways are the responsibility of the Contractor. On-site permits are the responsibility of the School District.

§ 3.7.1.2 Where inspections required by the Contract Documents and indicated to be by the Owner, require re-inspection, following the second inspection to comply with requirements, the Contractor will be charged \$200.00 per each additional inspection required until approval for the Architect and each consultant for each trade not complete.

§ 3.9 Superintendent

Add Section 3.9.4 to Section 3.9:

§ 3.9.4 The Superintendent and Project Coordinator are subject to the approval of the Owner. Should the Owner request removal of either one during the course of the Work, replacements, acceptable to the Owner shall be provided to permit the Project to proceed without delay.

§ 3.12 Shop Drawings, Product Data and Samples

Add Section 3.12.11 to Section 3.12:

§ 3.12.11 The Architect's review of Contractor's submittals will be limited to examination of an initial submittal and one (1) resubmittal. The Contractor shall reimburse the Owner for amounts paid to the Architect for evaluation of additional resubmittals.

§ 3.18 Indemnification

Add the following to the end of Section 3.18.1:

The Contractor's duty to indemnify and hold harmless shall extend to contract claims against the Owner by any Subcontractor or third party arising from errors, negligence or omissions of the Contractor or Contractor's alleged failure to pay amounts due and owing.

ARTICLE 4 ARCHITECT

§ 4.2.2

Add Section 4.2.2.1 to Section 4.2.2:

§ 4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for site visits made necessary by the fault of the Contractor or by defects and deficiencies in the Work.

§ 4.2.4 Communications

Delete Section 4.2.4 and substitute the following:

§ 4.2.4 The Owner and Contractor shall communicate with each other through the Architect about matters arising out of or 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.

§ 4.2.7

Add Section 4.2.7.1 to Section 4.2.7:

§ 4.2.7.1 In no case will the Architect's review period on any submittal be less than ten (10) days after receipt of the submittal from the Contractor.

§ 4.2.14

Add Section 4.2.14.1 to Section 4.2.14:

§ 4.2.14.1 Contractor's requests for information shall be prepared and submitted in accordance with Division 1 "General Requirements" sections on the form(s) indicated in Section 013100 "Project Management and Coordination." The Architect will return without action requests for information that do not conform to requirements of the Contract Documents.

ARTICLE 5 SUBCONTRACTORS

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

Revise the first two lines of Section 5.2.1 to read:

The Contractor, no later than two days after award of the Contract, shall furnish in writing to the Owner through the Architect the names of the persons or entities....

Add Section 5.2.5 to Section 5.2:

§ 5.2.5 As part of the Proposal, the Contractor shall furnish in writing to the Owner through the Architect the names of persons or entities proposed as manufacturers or fabricators for certain products, equipment and systems identified in the General Requirements (Division 1 of the Specifications) and where applicable the name of the installing Subcontractor. The Architect may reply within 5 days to the Contractor in writing stating (1) whether the Owner or Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time to review. Failure of the Owner or Architect to reply within a 14-day period shall constitute notice of no reasonable objection.

§ 5.4 Contingent Assignment of Subcontracts

Delete Section 5.4 in its entirety.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

Delete all references to waiver of subrogation in Section 6.1.1.

§ 6.2 Mutual Responsibility

Delete the second sentence of Section 6.2.3.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

Add Section 7.1.4 and Section 7.1.5 to Section 7.1:

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

- .1 Total mark-up presented to the Owner shall not exceed 10 percent of the cost. This percentage shall include mark-up for Sub-Contractors or Sub-sub contractors.
- .2 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.4.

§ 7.1.5 In order to facilitate checking of proposals for increases or decreases to the contract sum, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving over \$5,000.00 be approved without such itemization.

§ 7.2 Change Orders

Delete Section 7.2.1 and substitute the following, including Section 7.2.2:

§ 7.2.1 A Change Order is a written instrument 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.

§ 7.2.2 Except as otherwise provided in the Contract Documents, the Contractor shall prepare the Change Order form, which may include supporting materials prepared by the Architect, for review and approval by the Owner and Architect.

§ 7.3 Construction Change Directives

Delete Section 7.3.4.5 and substitute the following:

- .5 Additional costs of supervision and field office personnel, and processing of documentation of the change is considered to be part of general conditions and is not attributable to the change for general construction work or work performed under allowance amounts.

ARTICLE 8 –TIME

Add the following sentence to Section 8.1.4:

The term “working day” shall mean any calendar day except Saturday, Sunday and legal holidays at the Project Site.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.3 Applications for Payment

§ 9.3.1

Add the following sentence to Section 9.3.1:

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

Add Section 9.3.1.3 to Section 9.3.1:

9.3.1.3 Payments made shall be 95 percent of scheduled values requested by each application for payment. Retainage shall be 5 percent and shall be withheld until final application for payment upon completion of the work. Retainage shall be held in an interest-bearing account and distributed upon disbursement on a pro rata basis among all sub-contractors in accordance with Utah Legislation HB 382.

Add Section 9.3.2.1 to Section 9.3.2:

§ 9.3.2.1 Progress payments for stored materials in a bonded warehouse will be paid in accordance with paragraph 9.3.1.3.

§ 9.5 Decisions to Withhold Certification

Add Section 9.5.1.8 to Section 9.5.1:

- .8 Nothing in this Agreement shall be construed to create a third party beneficiary contract, agency or any other relationship between Owner and any subcontractor or sub-contractor.

§ 9.7 FAILURE OF PAYMENT

Revise Section 9.7 to read fifteen (15) days wherever it refers to seven days.

§ 9.8 Substantial Completion

Delete Section 9.8.1 and substitute the following:

§ 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. The following items, completed in their entirety, shall qualify the Work for Substantial Completion:

- .1 Completion of all scheduled finishes: flooring, ceilings, interior architectural woodwork, (finish wall, ceiling and floor coatings), acoustical treatments, visual display boards, partitions and accessories.
- .2 Completion of all doors and door hardware, functioning as scheduled.
- .3 Completion of all roof systems.
- .4 Completion of all building envelope systems.
- .5 Completion of all window systems.
- .6 Completion of all door access controls and door control devices.
- .7 Completion of all A/V, data and phones systems.
- .8 Completion of all light fixtures and day lighting control systems.
- .9 Completion of all exterior light fixtures.
- .10 Completion of all fire and smoke alarm systems.
- .11 Completion of all automatic sprinkler system.
- .12 Completion of complete mechanical system, mechanical controls system online & completed testing and balancing report.
- .13 Completion of all mechanical and plumbing fixtures, connected and functioning.
- .14 Completion of all exterior walkways, drives and parking systems and all associated drainage systems.
- .15 Completion of all landscaping and irrigation systems.

- .16 Completion of all exterior accessories and equipment (benches, trash receptacles, exterior sports equipment, chain link fences, ornamental metal fences and gates).

§ 9.8.3.1

Add Section 9.8.3.1 to Section 9.8.3:

§ 9.8.3.1 The Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections.

§ 9.8.6

Add Section 9.8.6 to Section 9.8:

§ 9.8.6 The certificate issued by the Contractor shall warrant to the Owner that the work has been performed according to and complies with plans and specifications, that all work is performed in a good and workmanlike manner and that there are no undisclosed latent dangers in the construction.

§ 9.9 Partial Occupancy or Use

Delete Section 9.9.1 and substitute the following:

§ 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 the Owner and approved as to safety by Owner's inspectors. Such partial occupancy or use may commence whether or not the portion is substantially completed. In the event of such partial use or occupancy, the Owner and Contractor shall specify in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and the Owner has designated in writings the period for correction of the Work and commencement of warranties required by the Contract Documents, so long as the original schedule is not shortened.

§ 9.9.1.1 When the Contractor considers a portion of the Work substantially complete, the Contractor shall prepare and submit a list to the Architect as provided in subparagraph 9.8.2. 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.

§ 9.10 Final Completion and Final Payment

§ 9.10.1.1

Add Section 9.10.1.1 to Section 9.10.1:

§ 9.10.1.1 The Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections.

§ 9.10.2.1

Add Section 9.10.2.1 to Section 9.10.2:

§ 9.10.2.1 The Certificate of Final Completion provided by the Contractor to the Owner constitutes a warranty to the Owner that the Work has been performed according to and complies with the Contract Documents, that all Work is performed in a good and workmanlike manner and that there are no undisclosed latent dangers in the construction.

§ 9.10.4

Add Sections 9.10.4.5, 9.10.4.6 and 9.10.4.7 to Section 9.10.4 (delete "or" in Section 9.10.4.3 and

replace the period in Section 9.10.4.4 with a colon):

- .4 any Owner liability arising from defects or dangers known to Architect or Contractor that were not disclosed in writing to Owner;
- .5 any liquidated damages and penalties resulting from failure to timely complete the Work; or
- .6 any claims for fraud or fraudulent concealment.

§ 9.11

Add Section 9.11 to Article 9:

§ 9.11 Damages

§ 9.11 1 The Contractor and the Contractor's surety shall be liable for and shall pay the Owner the sums hereinafter stipulated as liquidated damages, and not as a penalty, for each calendar day of delay after the date established for Substantial Completion until the work is substantially complete, including all punch list items: One Thousand dollars (\$1,000.00) per day.

The owner reserves the right to assess actual damages or continue liquidated damages.

ARTICLE 10 PROTECTION OF PERSONS AND PREPRTY

§ 10.2 Safety of Persons and Property

Add Section 10.2.1.4 to Section 10.2.1:

- .4 Third parties who are invited onto the site or who may otherwise reasonably be expected to access the site.

Add Section 10.2.2.1 to Section 10.2.2:

§ 10.2.2.1 Nothing herein shall be construed to subject the Owner to the jurisdiction of local or state authorities except to the extent required by law.

Add Section 10.2.6.1 to Section 10.2.6:

§ 10.2.6.1 The contractor shall institute a safety program at the start of construction to minimize accidents, until Final completion of the Project and conform to the latest requirements of the State Occupational and Safety Health Act.

§ 10.2.8 Injury or Damage to Person or Property

Add the following paragraph to Section 10.2.8:

The Contractor shall provide the Architect with a copy of all reports of accidents and claims arising out of or in connection with the performance of the work. He shall immediately notify the Architect of accidental death, major injury to persons, and extensive damage to the work. If any claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Architect, giving full details of the claim.

Add Sections 10.2.9 through 10.2.13 to Section 10.2:

§ 10.2.9 The Contractor shall keep areas affected by the work or adjacent to the site free from snow, ice, rubbish, excavation, encumbrances or any obstacles resulting from the construction operations, and in safe condition to the reasonable satisfaction of the authorities having jurisdiction.

§ 10.2.10 The Contractor shall at all times provide protection against weather, rain, winds, storms, frost or heat, so as to maintain all work, materials, apparatus and fixtures, free from injury or damage. At the end of the day's work, all new work reasonably likely to be damaged shall be covered.

§ 10.2.11 Adequate precautions shall be taken against fire throughout all the Contractor's operations. The

amount of flammable material shall be reduced to a minimum consistent with the proper handling and storing of materials. Except as otherwise provided herein, the Contractor shall not permit fires to be built or open salamanders to be used in any part of the work.

§ 10.2.11 The Contractor shall provide at the site, and make available to all workers, medical supplies and equipment necessary to supply first aid service to all persons who may be injured in connection with the work.

§ 10.2.12 The Contractor shall provide the Architect with a copy of all reports of accidents and claims arising out of or in connection with the performance of the work. He or she shall immediately notify the Architect of accidental death, major injury to persons, and extensive damage to the work. If any claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Architect, providing full details of the claim.

§ 10.3 Hazardous Materials

Add the following to the end of Section 10.3.2:

“...provided that the presence of hazardous materials was not foreseeable to Contractor at the time of entering into this Agreement.”

Delete Section 10.3.3.

ARTICLE 11 - INSURANCE AND BONDS

§ 11.1.2

Add Sections 11.1.2.1, 11.1.2.2 and 11.1.2.3 to Section 11.1.2:

§ 11.1.2.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. 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 100 percent of the Contract Sum.

§ 11.1.2.2 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 the 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.

§ 11.1.2.3 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.

§ 11.2 Owner's Insurance

Delete Section 11.2.1 and substitute the following:

§ 11.2.1 The Owner shall provide insurance available to it from Utah State Risk Management to cover the Site.

Delete Sections 11.2.2 and 11.2.3.:

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.2 Correction of Work

Add the following paragraph to Section 12.2.2.1:

Nothing herein shall be construed to waive claims Owner has against Contractor for failure to build according to plan or in accordance with authorities having jurisdiction. All work performed during the one-year period shall be performed at Contractor's expense.

§ 12.2.2

Add Section 12.2.2.4 to Section 12.2.2:

§ 12.2.2.4 Upon request by the Owner and prior to the expiration of one year from the date of Substantial Completion, the Architect will conduct, and the Contractor shall attend, a meeting with the Owner to review the facility operations and performance.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.2 Successors and Assigns

Delete the second sentence in Section 13.2.2.

Add Section 13.6 to Article 13:

§ 13.6 Non-Discrimination and Affirmative Action.

§ 13.6.1 The Contractor shall maintain policies of employment as follows:

- .1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but are not limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.
- .2 The Contractor and Contractor's Subcontractors shall, in all solicitations or advertisement for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

§ 13.7 Confidential Information

Add Section 13.7:

§ 13.7 If the Owner or Contractor receives information specifically designated by the other party as "confidential" or "business proprietary," the receiving party shall keep such information strictly confidential and shall not disclose it to any other person except to (1) those who need to know the content of such information in order to perform services or construction solely and exclusively for the Project, including its employees, or (2) its consultants and contractors whose contracts include similar restrictions on the use of confidential information. However, the party receiving "confidential" or "business proprietary" information may disclose such information, after seven (7) days' Notice to the party providing the confidential or business proprietary information, 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 arbitrator(s) order. Notice shall be provided, and deemed to have been duly served, in accordance with § 1.6.2 of A201-2017.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

Delete Section 14.1.3 and replace with the following:

§ 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 costs incurred by reason of such termination.

§ 14.3 Suspension by the Owner for Convenience

Delete Section 14.3.1 and replace with the following:

§ 14.3.1 The Owner may terminate for convenience as long as the Contractor is paid in full for all work performed and costs incurred through the date of termination.

Add Section 14.5 to Article 14:

§ 14.5 Nothing herein shall be construed to subject the Owner to the jurisdiction of local or state authorities except to the extent required by law.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1.5 Claims for Additional Cost

Add the following to Section 15.1.5:

However, an addition to the Contract Sum shall be permitted only in the event of a material addition not contemplated in the Contract Documents.

§ 15.1.6 Claims for Additional Time

Modify the language in Section 15.1.6.2 to read:

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, the Claim shall be documented by data substantiating that the weather conditions upon which the Claim is based (1) were abnormal when compared to the previous five-year period, during the same time frame and at the location of the Work, (2) could not have been reasonably anticipated, and (3) had an adverse effect on the date of substantial completion of the Work.

Add Sections 15.1.6.3 and 15.1.6.4 to Section 15.1.6:

§ 15.1.6.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work, and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

§ 15.1.6.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

§ 15.1.7 Waiver of Claims for Consequential Damages

Add the following sentence to Section 15.1.7:

If, before expiration of 30 days from the date of execution for this Agreement, the Owner obtains by separate agreement and furnishes to the Contractor a similar mutual waiver of all claims from the Architect against the Contractor for consequential damages which the Architect may incur as a result of any act or omission of the Owner or Contractor, then the waiver of consequential damages by the Owner and Contractor contained in this Section 15.1.7 shall be applicable to claims by the Contractor against the Architect.

Delete Section 15.1.7.1.

Delete the following from Section 15.1.6.2:

...except anticipated profit arising directly from the Work.

Modify the last sentence in Section 15.2.5 to read:

The initial decision shall be final and binding on their parties but subject to the rights of the parties to assert their claims in a court of law or by mediation.

§ 15.3 Meet and Confer as Condition Precedent to Mediation

Before Section 15.3, Mediation, add the below new Section 15.3 and renumber succeeding paragraphs as necessary:

§ 15.3 Meet and Confer

§ 15.3.1 Any claim, dispute or other matter in question arising out of or related to this Agreement shall be subject to a meet and confer session as a condition precedent to mediation.

§ 15.3.2 The meet and confer session shall be attended by members of the Owner and Contractor's senior management, who shall have full authority to bind their respective party with respect to the Claim, dispute or other matter in question. The meet and confer session shall take place within fourteen (14) days after a request by either party, unless the parties mutually agree otherwise.

§ 15.3.3 If the parties reach a mutually acceptable resolution, then they shall prepare appropriate documentation memorializing the resolution. If the parties cannot reach a mutually acceptable resolution, they shall proceed to mediation in accordance with Section 15.4.

§ 15.3 Mediation

Amend to state "may" wherever the word "shall" appears in this article.

§ 15.4 Arbitration

Delete paragraph § 15.4 and all of its subparts in their entirety.

Add the following article:

ARTICLE 16 ADDITIONAL RESPONSIBILITIES

§ 16.1 Signs

§ 16.1.1 Temporary Signs shall not be permitted without review of the Architect.



AIA® Document A101® – 2017 Exhibit A

Insurance and Bonds

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

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

THE OWNER:
(Name, legal status and address)

THE CONTRACTOR:
(Name, legal status and address)

TABLE OF ARTICLES

- A.1 GENERAL
- A.2 OWNER'S INSURANCE
- A.3 CONTRACTOR'S INSURANCE AND BONDS
- A.4 SPECIAL TERMS AND CONDITIONS

ARTICLE A.1 GENERAL

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

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

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

§ A.2.2 Liability Insurance

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

§ A.2.3 Required Property Insurance

§ A.2.3.1 The Owner shall provide insurance on the site as provided through State Risk Management." add the following: The deductible shall be \$5,000.00 per claim. Contractor

ADDITIONS AND DELETIONS:

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

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

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

Init.

shall pay the deductible.

Unless otherwise provided in the Contract Document, the property insurance provided by the Owner will cover materials and portions of the work stored on the project site, but not yet installed in the building or structure. The Contractor shall be responsible to provide property insurance for all risks of physical loss including theft or portions of the work stored off the project site or in transit, regardless of Owners title as outlined in Paragraph 9.3.2. In the event Contractor fails to maintain the required insurance for materials stored off-site and in transit, he shall bear financial responsibility for the full replacement cost of any loss.

§ A.2.3.1.1 Causes of Loss. N/A

§ A.2.3.1.2 Specific Required Coverages. N/A

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

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. N/A

§ A.2.3.1.5 The insurance required by Section A.2.3 is not intended to cover machinery, tools or equipment owned or rented by the Contractor that are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools or equipment, which shall be subject to the provisions of Section 11.3.

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

§ A.2.3.3 Insurance for Existing Structures

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

§ A.2.4 Optional Extended Property Insurance. N/A

§ A.2.5 Other Optional Insurance. N/A

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

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

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

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

§ A.3.2 Contractor's Required Insurance Coverage

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

(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

Products and Completed Operations insurance shall be maintained for a minimum period of at least One (1) year after the expiration of the period for correction of the Work.

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than One Million Dollars and Zero Cents (\$ 1,000,000.00) each occurrence, Two Million Dollars and Zero Cents (\$ 2,000,000.00) general aggregate, and Two Million Dollars and Zero Cents (\$2,000,000.00) aggregate for products-completed operations hazard, providing coverage for claims including

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

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

- .1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
- .2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
- .3 Claims for bodily injury other than to employees of the insured.
- .4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
- .5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
- .6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
- .7 Claims related to roofing, if the Work involves roofing.
- .8 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
- .9 Claims related to earth subsidence or movement, where the Work involves such hazards.
- .10 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.2.3 The policy shall be endorsed to have the General Aggregate apply to this Project only.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than One Million Dollars and Zero Cents (\$ 1,000,000.00) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 Umbrella or Excess Liability Coverage: Five Million Dollars and Zero Cents (\$5,000,000.00).

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 If this insurance is written on a Comprehensive General Liability policy form, the certificate shall be ACORD form 25-S completed and supplemented in accordance with AIA Document G715-1991, Instruction Sheet and Supplemental Attachment for ACORD Certificate of Insurance 25-S.

Specifically set forth evidence of all coverage required by Paragraphs A.3.2.2. Furnish to the Owner copies of any endorsements that are subsequently issued amending coverage or limits.

§ A.3.3 Contractor's Other Insurance Coverage

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

(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:

(Specify type and penal sum of bonds.)

Type	Penal Sum (\$0.00)
Payment Bond	Equal to 100% of Contract Sum
Performance Bond	Equal to 100% of Contract Sum

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

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

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

Coverage on a claims-made basis is not acceptable.

SECTION 011000 – SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Work covered by Contract Documents.
2. Owner-furnished/Contractor-installed (OFCl) products.
3. Owner-furnished/Owner-installed (OFOI) products.
4. Contractor's use of site and premises.
5. Work restrictions.
6. Specification and Drawing conventions.

B. Related Requirements:

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

1.2 PROJECT INFORMATION

A. Project Identification: Jordan Learning Center.

1. Project Location: 3706 West 9800 South, South Jordan, Utah 84009.

B. Owner: Jordan School District, 7387 S. Campus View Drive, West Jordan, UT 84084.

C. Architect: MHTN Architects, 280 South 400 West, Suite 250, Salt Lake City, Utah 84101.

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. The Project consists of renovating a Walmart store into a Learning Center for the District. It is a single story building of approximately 41,000 sq. ft. and includes exterior improvements, demolition, and new systems, materials and finishes as shown in the Drawings.

1.4 CONTRACTS

A. Project will be constructed under a single prime contract, with subcontractors and suppliers under contract to the General Contractor.

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

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
2. Provide for delivery of Owner-furnished products to Project site.
3. Upon delivery, inspect, with Contractor present, delivered items.
 - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
4. 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. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
5. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. Toilet Accessories: Refer to Section 102800 "Toilet, Bath, and Laundry Accessories."

1.6 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

A. Owner-Furnished/Owner-Installed (OFOI) Products:

1. Carpet tile and adhesive.

1.7 CONSTRUCTION SCHEDULE – MANPOWER REQUIREMENTS

A. Contractors shall provide adequate personnel and/or extend workdays and work weeks to comply with the schedule requirements of this project.

B. Construction Schedule:

1. Notice to Proceed: Upon Board Approval.
2. Construction Start: On or near 1 November 2024.
3. Substantial Completion: 1 August 2024.

1.8 USE OF PREMISES

A. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
 - 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.
- B. 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.
- C. 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.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not used)

END OF SECTION 011000

SECTION 012100- ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
 - 1. Certain materials and equipment are specified in the Contract Documents by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Quantity allowances.
 - 3. Contingency allowances.
- C. Related Sections include the following:
 - 1. Section 012200 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
 - 2. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 3. Division 1 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.3 SELECTION AND PURCHASE

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

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

1.6 QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.2 CONTINGENCY ALLOWANCES

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

1.7 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.
 3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs due to a change in the scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 01: Lump-sum Allowance: Provide an allowance of \$50,000 for AV equipment as indicated on Drawings.
- B. Allowance No. 02: Quantity Allowance: Include ten (10) non-rated access doors, 24 by 24 inches, locations to be reviewed with Architect, as specified in Section 083113 "Access Doors and Frames".
1. This allowance includes material cost, receiving, handling, installation, and Contractor overhead and profit.
- C. Allowance No. 3: Contingency Allowance: Include a contingency allowance of \$400,000.00 for use according to Owner's written instructions.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for unit prices.
- B. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Division 1 Section "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

- A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.
- B. Measurement and Payment: Refer to 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 list of unit prices is included in Part 3. Specification Sections referenced in the schedule 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: Security Glazing Film.

1. Description: Provide a unit price to install the glazing film on windows and storefront not indicated to receive glazing film, in accordance with Section 088723 "Security Glazing Film."
2. Unit of Measurement: Provide a cost for each of the following:
 - a. Film Installation: One square foot of film, installed from edge to edge of the glass unit.
 - b. Window Removal and Reinstallation: Include removal and reinstallation a typical glass unit of approximately 20 to 25 sq. ft.

END OF SECTION

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if 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 for each alternate is the net addition to the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify 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. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 01: Pallet Rack Shelving

1. Base Bid: Provide pallet rack static shelving at Warehouse as indicated on Drawings.
 - a. Refer to Section 105613 "Metal Storage Shelving."
2. Alternate: Provide high density pallet rack shelving at Warehouse as indicated on Drawings.
 - a. Refer to Section 105626 "Mobile Storage Shelving."

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 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.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use facsimile of form provided in Project Manual.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

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

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 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.

1.4 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 seven days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

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 AIA Document G709 for Proposal Requests.

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 or similar form.

1.6 CONSTRUCTION CHANGE DIRECTIVE

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Section 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.

1.3 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.

1.4 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.
- 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. Name of Architect.
 - c. Architect's Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 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: Include total cost and proportionate share of general overhead and profit for each line item.
 6. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 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 Agreement between Owner and Contractor. 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 or Owner's required forms as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.

2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit two signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following, with no exceptions:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
 5. Products list (preliminary if not final).
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 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.
- G. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- H. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706.
 5. AIA Document G706A.
 6. AIA Document G707.
 7. Evidence that claims have been settled.

8. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. RFIs.
 - 4. Digital project management procedures.
 - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 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.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

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

- B. Key Personnel Names: Within 5 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 and 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.

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

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.

- c. Panel board, switch board, switchgear, transformer, busway, generator, and motor-control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Architect will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 1. File Preparation Format: DWG, Version AutoCAD 2016 or later, operating in Microsoft Windows operating system.
 2. File Submittal Format: Submit or post coordination drawing files using PDF format.
 3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in AutoCAD, 2018 or later.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement included in this Project Manual.

1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.

10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
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 working 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 10 days of receipt of the RFI response.
- E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- 1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES
- A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.
1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD, version 2018.

4. Contractor shall execute a data licensing agreement in the form of License and Indemnification 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 License and Indemnification Agreement included in this Project Manual.
 5. The following digital data files will be furnished for each appropriate discipline:
 - a. Floor plans.
 - b. Reflected ceiling plans.
- B. Web-Based Project Software: Use Architect's web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.
1. Web-based Project software site 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. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
 - e. Processing and tracking of payment applications.
 - f. Processing and tracking of contract modifications.
 - g. Creating and distributing meeting minutes.
 - h. Document management for Drawings, Specifications, and coordination drawings, including revision control.
 - i. Management of construction progress photographs.
 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.
 3. Web-based Project software:
 - a. Bluebeam Inc.
- 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.

1.9 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 10 working 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: 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. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at regular 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

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 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. Construction Schedule Updating Reports: Submit with Applications for Payment.

- D. Daily Construction Reports: Submit at weekly intervals.
- E. Site Condition Reports: Submit at time of discovery of differing conditions.
- F. Unusual Event Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including work stages.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review schedule for work of Owner's separate contracts.
 - 6. Review submittal requirements and procedures.
 - 7. Review time required for review of submittals and resubmittals.
 - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 9. Review time required for Project closeout and Owner startup procedures.
 - 10. Review and finalize list of construction activities to be included in schedule.
 - 11. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
 - 1. Comply with AGC's "Construction Planning and Scheduling."
- B. Time Frame: Extend schedule from date established for commencement of the Work or the Notice to Proceed to date of Substantial Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

- C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 30 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 5. Commissioning Time: Indicate time for systems commissioning as specified in Division 23 sections.
 6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 2. Owner-Furnished Products: Include a separate activity for each product.
 3. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use-of-premises restrictions.
 - f. Seasonal variations.
 - g. Environmental control.
 4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.
 - m. Commissioning.

5. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.

 - E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

 - F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and the Contract Time.

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

 - H. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

 - I. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.
- 1.8 CPM SCHEDULE REQUIREMENTS
- A. General: Prepare network diagrams using AON (activity-on-node) format.

- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and inspection.
 - j. Commissioning.
 - k. Punch list and final completion.
 - l. Activities occurring following final completion.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 - 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
 - F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Main events of activity.
 - 4. Immediate preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
 - 10. Dollar value of activity (coordinated with the schedule of values).
 - G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.
 - H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
 - 1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 - 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 - 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 - 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.
- 1.9 REPORTS
- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.

4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Testing and inspection.
 8. Accidents.
 9. Meetings and significant decisions.
 10. Unusual events.
 11. Stoppages, delays, shortages, and losses.
 12. Meter readings and similar recordings.
 13. Emergency procedures.
 14. Orders and requests of authorities having jurisdiction.
 15. Change Orders received and implemented.
 16. Construction Change Directives received and implemented.
 17. Services connected and disconnected.
 18. Equipment or system tests and startups.
 19. Partial completions and occupancies.
 20. 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

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 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 seven days of taking photographs.
 - 1. Submit photos by uploading to web-based project 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 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.

1.4 QUALITY ASSURANCE

- A. Construction Webcam Service Provider: A firm specializing in providing photographic equipment, web-based software, and related services for construction projects, with record of providing satisfactory services similar to those required for Project.

1.5 FORMATS AND MEDIA

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

1.6 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. 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.
- C. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Periodic Construction Photographs: Take 20 photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

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

- B. Related Requirements:

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

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's 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."

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and 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: 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: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule 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.

1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
 2. Date.
 3. Name of Architect.
 4. Name of 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. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website.
- 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 10 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 10 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 and Construction Manager's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

1.7 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
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 kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two 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.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit two sets of Samples. Architect will retain one Sample sets; remainder will be returned.

- 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- 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 Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

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.

1.8 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 CONTRACTOR'S REVIEW

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

- 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.

1.10 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
 - 1. Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
 - 2. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action, as follows:
 - a. Final Unrestricted Release: Where the submittal is marked "No Exception Taken," the Work covered by the submittal may proceed, provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
 - b. Final-but-Restricted Release: Where the submittal is marked "Make Corrections Noted," the Work covered by the submittal may proceed, provided it complies both with Architect's notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.
 - c. Resubmit: Where the submittal is marked "Exception Taken - Resubmit" do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to Architect's notations and corrections.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests: 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 trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

- D. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
- E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as 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.

1.4 DELEGATED-DESIGN SERVICES

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

1.5 CONFLICTING REQUIREMENTS

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

1.6 ACTION SUBMITTALS

- A. Shop Drawings: For mockups.
 - 1. Include plans, sections, and elevations, indicating materials and size of mockup construction.
 - 2. Indicate manufacturer and model number of individual components.
 - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.
- B. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Contractor's quality-control personnel.
- B. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- C. 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.
- D. 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.
- E. Reports: Prepare and submit certified written reports and documents as specified.
- F. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's Construction Schedule.
- B. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- C. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including Subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.
- D. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- E. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.

13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement 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 whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups of size indicated.
 2. Build mockups in location indicated or, if not indicated, as directed by Architect.
 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
 5. Demonstrate the proposed range of aesthetic effects and workmanship.

6. Obtain Architect's approval of mockups before starting corresponding work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 8. Demolish and remove mockups when directed unless otherwise indicated.
- L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.
- 1.11 QUALITY CONTROL
- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 2. 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 shall 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. **Associated Contractor Services:** Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. **Schedule of Tests and Inspections:** Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses.
1. **Distribution:** Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.12 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's 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 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

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

1.3 INDUSTRY STANDARDS

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

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

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
 - 1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 - 2. ICC - International Code Council; www.iccsafe.org.
 - 3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
 - 1. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 - 2. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 - 3. DOD - Department of Defense; www.quicksearch.dla.mil.
 - 4. DOE - Department of Energy; www.energy.gov.
 - 5. EPA - Environmental Protection Agency; www.epa.gov.
 - 6. FG - Federal Government Publications; www.gpo.gov/fdsys.
 - 7. GSA - General Services Administration; www.gsa.gov.
 - 8. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 - 9. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 - 10. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 - 11. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
 - 12. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 - 13. USPS - United States Postal Service; www.usps.com.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 - 2. FED-STD - Federal Standard; (See FS).

3. FS - Federal Specification; Available from DLA Document Services;
www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
4. USAB - United States Access Board; www.access-board.gov.
5. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes 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.

1.3 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, Architect, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use with metering. Provide connections and extensions of services and metering as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 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. 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.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

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 concrete 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.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

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.

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. 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.
- C. 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.
- D. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- B. 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.
- C. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- D. 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.

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. 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.
- F. 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.
- G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- H. 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.
- I. 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. 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.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
- 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.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for products selected under an allowance.
 - 2. Section 012300 "Alternates" for products selected under an alternate.
 - 3. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 4. Section 014200 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other 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, if applicable.

1.4 ACTION SUBMITTALS

- A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Architect's Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 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-connected 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 identification requirements.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Architect, whose determination is final.
- B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: ...!"
 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: ...!"

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will will not be considered unless otherwise indicated.
 - a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: ...!"
 4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
 - a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: ...!"
 5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience be considered.
 - a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: ...!"
 6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: ...!"
 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

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

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

- B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting surveys.
2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
3. Section 024119 "Selective Demolition" for removal of selected portions of the building or structure.
4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 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.

1.4 PREINSTALLATION MEETINGS

- A. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:]
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Plumbing piping systems.
 - f. Mechanical systems piping and ducts.
 - g. Control systems.
 - h. Communication systems.
 - i. Fire-detection and -alarm systems.
 - j. Conveying systems.
 - k. Electrical wiring systems.
 - 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.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: 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, 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.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.

4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify 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 and Construction Manager.

3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 108 inches in occupied spaces and 96 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Where possible, 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.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

- J. Repair or remove and replace damaged, defective, or nonconforming Work.
 - 1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.5 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. 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.
- F. 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.
- G. 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.
6. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 COORDINATION OF OWNER'S PORTION OF THE WORK

- A. Site Access: Provide access to Project site for Owner's construction personnel.
 1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
 2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed products.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 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.
- C. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 OWNER-PROVIDED PRODUCTS

- A. Installation: Install Owner provided dispensers and equipment where indicated on Drawings or in the Project Manual.

3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. 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.
- B. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- C. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- D. Restore permanent facilities used during construction to their specified condition.
- E. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- F. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- G. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Disposing of nonhazardous demolition construction waste.
- B. Related Requirements:
 - 1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
 - 2. Section 024119 "Selective Demolition" for demolition and removal of portions of building or structure.
 - 3. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.6 INFORMATIONAL SUBMITTALS

- A. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- B. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.7 QUALITY ASSURANCE

- A. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within seven days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 DISPOSAL OF WASTE

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

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

- B. Related Requirements:

1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.3 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

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

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit 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.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. 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.
4. Submit list of incomplete items in one of the following formats:
 - a. PDF electronic file. Architect will return annotated file.
 - b. Web-based project software upload. Utilize software feature for transmitting and updating list of incomplete items (punch list).

1.7 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit on digital media acceptable to Architect or 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.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are 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. Sweep concrete floors broom clean in unoccupied spaces.
- i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
- j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
- k. Remove labels that are not permanent.
- l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
- p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
- q. Leave Project clean and ready for occupancy.

- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. 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.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to Architect by uploading to web-based project software site. Enable reviewer comments on draft submittals.

2. Submit two paper copies. Architect will return two copies for transmittal to the Owner.
- 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.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 9. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 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.

1.9 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.

1.10 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.
 - J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 1. Do not use original project record documents as part of maintenance manuals.
- 1.11 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 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

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

- C. Record Product Data: Submit one paper copy or annotated PDF electronic files and directories (verify with Architect) 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.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy or annotated PDF electronic files and directories (verify with Architect) of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 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 sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 5. Note related Change Orders, record Product Data, and record Drawings where applicable.

- B. Format: Submit record Specifications as annotated PDF electronic file.

1.6 RECORD PRODUCT DATA

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

1.7 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.8 MAINTENANCE OF RECORD DOCUMENTS

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

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator, instructor, and videographer.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 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 Construction Manager.
 - e. Name of Contractor.

- f. Date of video recording.
2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. Transcript: 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.
4. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 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.

1.7 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

1. Motorized doors
2. Equipment
3. Fire protection systems
4. Heat generation equipment
5. Refrigerations systems
6. HVAC systems
7. HVAC instrumentation and controls
8. Electrical service, distribution and controls, including transformers and switchboards
9. Panelboards and motor controls
10. Lighting equipment and controls
11. Communication systems including surveillance.
12. Clocks, programming voice and data

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.

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.

1.8 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.

1.9 INSTRUCTION

- A. **Facilitator:** Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. **Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.**
 - 1. Owner will furnish Contractor with names and positions of participants.
- C. **Scheduling:** Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Construction Manager, with at least 14 days' advance notice.
- D. **Training Location and Reference Material:** Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. **Evaluation:** At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- F. **Cleanup:** Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. **General:** Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. **Digital Video Recordings:** Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
 - 1. Submit video recordings on CD-ROM or thumb drive.
 - 2. **File Hierarchy:** Organize folder structure and file locations according to 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 according to Project Manual table of contents:

- a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- C. 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.
- D. 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.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.
- H. Drawings and Documentation
1. Include drawings and documentation, in electronic format, delivered to the company contracted to create the digital training material.
 - a. Include civil, structural, electrical and mechanical engineering and architectural sections.
 - b. Index and hyper-link each page of the drawings. Place buttons on top of each page to return the user to the index.
 - c. Operation and maintenance information shall be provided by the Contractors and Suppliers providing the materials and equipment.
 2. All information shall be printable on plain paper.
 3. Link information so that the user can search for key words.
 4. Use text, images, graphics, sound, etc. to make the information more accessible and understandable.
 5. Convert all documentation to unchangeable Portable Document Format (PDF).
 6. Provide documentation on a CD or DVD, that auto-starts when inserted in a computer running the Windows operating system with any directions to continue appearing on the screen.

7. At the beginning or start-up of the DVD, provide a General Information index screen to direct the user to the desired portion of the manual. Include the following five major groups in the index screen:
 - a. Contacts, including names of architects, engineers and contractors, with addresses and telephone numbers.
 - b. Warranties List: A list of all Contractors with a link to their respective warranty information.
 - c. Drawings, indexed and hyper-linked as noted above.
 - d. Specifications: Include a bookmarked set of the Project Manual.
 - e. Manufacturers' Operation and Maintenance Manuals, including the following sections:
 - 1) Architectural or General Contractor section.
 - 2) Mechanical section.
 - 3) Electrical section.
 - 4) Special construction section.
 - f. Organize the Manufacturers' Operation and Maintenance Manuals with indexes in alphabetical order, and with hyperlinks to each manual.
 - 1) Include a table of contents in each volume, bookmarked to the contents of the volume.
 - 2) Provide navigational buttons at the top of each page to return the user back to the Index and to the Table of Contents.

PART 2 - PRODUCTS

2.1 SOURCE OF PROCUREMENT

- A. One local source of procurement is: Manuals Access, 2836 W. Stafford Place, West Valley City, UT 84119, Phone: 801-619-2082.

PART 3 - EXECUTION (Not Used)

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 017300 "Execution" for cutting and patching procedures.
 - 3. Section 096815 "Floor Preparation for Carpet" for preparing substrate for carpet.
 - 4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach 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, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- D. Predemolition Photographs or Video: Submit before Work begins.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- F. Warranties: Documentation indicated 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.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If 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. 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.

1.9 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
 - 1. Existing roof membrane.
- 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents, if available, of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Perform Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

- F. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs and preconstruction videotapes.
 - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."
 - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 - 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

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.
 - 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. 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 to be removed.
 - 1) Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 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.
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

- A. 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.
 - 1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

- C. Temporary Shoring: 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.

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, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain adequate ventilation when using cutting torches.
 - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 9. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

- B. 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 sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, 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."
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 075216 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Roofing" for new roofing requirements.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SITE MATERIALS

- A. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.
 - 1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
 - 2. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by Architect or governing authorities. Return adjacent areas to condition existing prior to start of work.
- B. Cutting Asphalt and Concrete Paving: Saw cut asphalt paving, and concrete paving with approved saws at lines and levels indicated on drawings. Saw cut concrete walks and curbs only if they cannot be removed to an existing control joint.
- C. Capping and Abandonment: Cap all abandoned lines and conduits and drains in accordance with requirements of Utility Companies having jurisdiction. Remove abandoned lines, unless otherwise noted.
- D. Overhead Utility Lines: The Utility companies that own or otherwise control the overhead utility lines, will remove and relocate their poles and overhead utility lines at the Owner's expense. The Contractor shall coordinate these utility changes with the proper utility companies.
- E. Permits: Contractor is required to obtain a Demolition Permit and Utility Disconnection Permits from the City and utility companies.
 - 1. Record on Record Document location and extent of all capped and abandoned lines below grade.
- F. Relocation: Relocate utilities as indicated. Work performed for relocation of utilities to conform to new utility line construction.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.8 BACKFILL

- A. Backfill all excavated areas associated with the removal of all substructures with a well-graded granular material having a maximum size of 2 inches and not more than 15 percent passing a #200 sieve. Place all earth materials in excavated areas in maximum 8-inch loose lifts and densified to an in-place unit weight equal to 95 percent of the Maximum Laboratory Density as determined by ASTM D 1557-78.
 - 1. Refer to Section 312000 "Earth Moving" for placement and compaction requirements.

3.9 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.

3.10 SELECTIVE DEMOLITION SCHEDULE

- A. Existing Construction to Be Removed: As indicated in the Drawings.
- B. Existing Items to Remain: As indicated in the drawings.

END OF SECTION 024119

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Form-facing material for cast-in-place concrete.
- 2. Shoring, bracing, and anchoring.

- B. Related Requirements:

- 1. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.

1.3 DEFINITIONS

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review the following:

- a. Special inspection and testing and inspecting agency procedures for field quality control.
- b. Construction, movement, contraction, and isolation joints.
- c. Forms and form-removal limitations.
- d. Shoring and reshoring procedures.
- e. Anchor rod and anchorage device installation tolerances.

1.5 ACTION SUBMITTALS

- A. Product Data: For each of the following:

- 1. Exposed surface form-facing material.
- 2. Concealed surface form-facing material.
- 3. Form ties.

4. Form-release agent.

B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.
 - a. Location of construction joints is subject to approval of the Architect.
3. Indicate proposed schedule and sequence of stripping of forms, shoring removal, and reshoring installation and removal.

1.6 INFORMATIONAL SUBMITTALS

A. Research Reports: For insulating concrete forms indicating compliance with International Code Council Acceptance Criteria AC308.

B. Minutes of preinstallation conference.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:
 - a. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 RELATED MATERIALS

- A. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- 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.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal cone snap 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.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes Section 033300 "Architectural Concrete".
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-1.0: ACI 117 Class D, 1 inch, for concealed surfaces.
 - 2. Surface Finish-3.0: ACI 117 Class A, 1/8 inch, for exposed surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.

- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 3. Place joints perpendicular to main reinforcement.
 - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 6. Space vertical joints in walls as indicated on Drawings.
 - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
 - 5. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

- A. 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.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work.
 - 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 - 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 - 1. Align and secure joints to avoid offsets.
 - 2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
 - 2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

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. Steel reinforcement bars.

- B. Related Requirements:

- 1. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review the following:

- a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Each type of steel reinforcement.
 - 2. Bar supports.
 - 3. Mechanical splice couplers.

- B. Shop Drawings: Comply with ACI SP-066:

- 1. Include placing drawings that detail fabrication, bending, and placement.
 - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
 - 3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.

- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M

B. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
2. Mechanical splice couplers.

C. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

- a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- C. Mechanical Splice Couplers: Type 1 or Type 2, as indicated in Drawings, same material of reinforcing bar being spliced; tension-compression type.
- D. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
 - 1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. 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.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
 - 2. Stagger splices in accordance with ACI 318.
 - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
 - 4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel-reinforcement placement.
 - 2. Steel-reinforcement mechanical splice couplers.
 - 3. Steel-reinforcement welding.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 031000 "Concrete Forming and Accessories" for form-facing materials.
 - 2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars.
 - 3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.
 - 4. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

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

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 - 2. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.

- b. Construction joints, control joints, isolation joints, and joint-filler strips.
- c. Semirigid joint fillers.
- d. Vapor-retarder installation.
- e. Anchor rod and anchorage device installation tolerances.
- f. Cold and hot weather concreting procedures.
- g. Concrete finishes and finishing.
- h. Curing procedures.
- i. Forms and form-removal limitations.
- j. Methods for achieving specified floor and slab flatness and levelness.
- k. Floor and slab flatness and levelness measurements.
- l. Concrete repair procedures.
- m. Concrete protection.
- n. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
- o. Protection of field cured field test cylinders.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
5. Fiber reinforcement.
6. Vapor retarders.
7. Floor and slab treatments.
8. Curing materials.
9. Joint fillers.
10. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Synthetic micro-fiber content.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction and Control Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction and control joints is subject to approval of the Architect.

D. Samples: For vapor retarder.

E. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

- F. Preconstruction Test Reports: For each mix design.
- G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.
 - 1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.
 - 1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
 - 1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.
 - f. Permeability.
 - g. Drying shrinkage for interior slab-on grade.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and ACI 301.

1.10 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. 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.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. 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 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II, gray.
2. Fly Ash: ASTM C618, Class C or F.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: Refer to General Structural Notes for limitations.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures 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 C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 FIBER REINFORCEMENT

A. Synthetic Macro-Fiber: Synthetic macro-fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, 1 to 2-1/4 inches long.

2.4 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A, except with maximum water-vapor permeance of 0.01 perms; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. Fortifiber Building Systems Group; Moistop Ultra 15.
 - b. Raven Industries, Inc; VaporBlock VB15.
 - c. Reef Industries, Inc; Griffolyn 15 Mil.
 - d. Stego Industries, LLC; Stego Wrap Vapor Barrier (15-Mil).
 - e. W.R. Meadows, Inc; Perminator 15 mil.

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. BASF Corporation; MasterKure ER 50.
 - b. ChemMasters, Inc; Spray-Film.
 - c. Euclid Chemical Company (The); an RPM company; Eucobar.
 - d. Laticrete International, Inc.; L&M E-CON.
 - e. Sika Corporation; SikaFilm.
 - f. W.R. Meadows, Inc; EVAPRE.

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 C171, polyethylene film burlap-polyethylene sheet.

1. Color:

- a. Ambient Temperature Below 50 deg F: Black.
 - b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
 - c. Ambient Temperature Above 85 deg F: White.
- D. Curing Paper: Eight-foot-wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. Fortifiber Building Systems Group; Sisalkraft SK-10.
- E. Water: Potable or complying with ASTM C1602/C1602M.
- F. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. BASF Corporation; MasterKure CC 1315WB.
 - b. Euclid Chemical Company (The); an RPM company; Aqua Cure VOX.
 - c. Laticrete International, Inc.; Dress & Seal WB.
 - d. Nox-Crete Products Group; Cure & Seal 100 E.
 - e. SpecChem, LLC; Cure & Seal WB.
 - f. W.R. Meadows, Inc; Vocomp-20.

2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Floor Slab Protective Covering: Eight-foot-wide cellulose fabric.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. McTech Group, Inc.; EZ Cover.

2.7 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.8 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash or Other Pozzolans: 25 percent by mass, unless indicated otherwise in General Structural Notes.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs concrete for parking structure slabs, and concrete with a w/cm below 0.50.

2.9 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings.
1. Exposure Class: As indicated.
 2. Minimum Compressive Strength: As indicated at 28 days.
 3. Maximum w/cm: As indicated in General Structural Notes.

- B. Class B: Normal-weight concrete used for foundation walls.
 - 1. Exposure Class: As indicated.
 - 2. Minimum Compressive Strength: As indicated at 28 days.
 - 3. Maximum w/cm: As indicated in General Structural Notes.

- C. Class C: Normal-weight concrete used for interior slabs-on-ground.
 - 1. Exposure Class: As indicated.
 - 2. Minimum Compressive Strength: As indicated at 28 days.
 - 3. Maximum w/cm: As indicated in General Structural Notes.
 - 4. Slump Limit: 5 inches, plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
 - 5. Air Content:
 - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
 - 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Daily access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
 - 4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.4 INSTALLATION OF VAPOR RETARDER

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

3.5 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.

7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.
- F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
 2. Deposit concrete to avoid segregation.
 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 3. Maintain reinforcement in position on chairs during concrete placement.
 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 5. Level concrete, cut high areas, and fill low areas.
 6. Slope surfaces uniformly to drains where required.
 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
 - b. Remove projections larger than 1 inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class D.
 - e. Apply to concrete surfaces not exposed to public view.

2. ACI 301 Surface Finish SF-3.0:
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/8 inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class A.
 - e. Locations: 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.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

1. Grout-Cleaned Rubbed Finish:
 - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
 - b. Do not clean concrete surfaces as Work progresses.
 - c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
 - d. Wet concrete surfaces.
 - e. 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.
 - f. Maintain required patterns or variances as shown on Drawings or to match mockups.

C. Related Unformed Surfaces:

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

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
3. Apply scratch finish to surfaces to receive mortar setting beds.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighthen until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
 - a. Slabs on Ground:
 - 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 15.
 - b. Suspended Slabs:
 - 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 15.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install 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.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
 - b. Floors to Receive Curing Compound:
 - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Maintain continuity of coating, and repair damage during curing period.
 - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
 - c. Floors to Receive Curing and Sealing Compound:
 - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.11 TOLERANCES

- A. Conform to ACI 117.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

- B. 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.

- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

- a. Limit cut depth to 3/4 inch.
- b. Make edges of cuts perpendicular to concrete surface.
- c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
- d. Fill and compact with patching mortar before bonding agent has dried.
- e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

- a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
- b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

- a. Correct low and high areas.
- b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including 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.

3. After concrete has cured at least 28 days, correct high areas by grinding.

4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
 5. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
 - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
 - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.
- 3.13 FIELD QUALITY CONTROL
- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
 - B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

- a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.

- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

- D. Inspections:
 1. Headed bolts and studs.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 6. Batch Plant Inspections: On a random basis, as determined by Architect.

- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 3. Slump Flow: ASTM C1611/C1611M:

- a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 5. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 6. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of two laboratory-cured specimens at seven 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. 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 if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
 9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 10. Additional Tests:
 - a. 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.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.
 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

13. Drying Shrinkage Tests: ASTM C157: One test for each interior slab-on-grade mix design, to be submitted with mix design.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Architect.

3.14 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

SECTION 033543 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Liquid floor treatments.
2. Polished concrete surface finish requirements.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for new concrete designed for polished concrete finishing, including concrete materials, mixture design, placement procedures, initial finishing, and curing.

1.2 DEFINITIONS

- A. Aggregate Exposure Class: Visual observation of polished floor aggregate surface exposure area after grinding and polishing operations. Aggregate exposure class ranges are A, B, and C.
- B. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.
- C. Distinctness of Image (DOI): The distinctness (clarity) of images reflected by the glossy coating surface appearance of the polished concrete finish appearance levels. The transmission of this reflection is measured in accordance with ASTM D5767.
- D. Haze: The cloudiness or milky appearance of images from objects produced by reflection in a polished concrete surface. The measurement of this appearance is defined in accordance with ASTM D4039. The test method reading is put into a calculation resulting in a Haze Index value.
- E. Specular Gloss: A reflectance value determined by a single measurement of gloss from shining a known amount of light at a surface within a specific angle of illumination in accordance with ASTM D523.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Cast-in-place concrete subcontractor.

- e. Polished concrete finishing subcontractor.
 - f. Architect.
 - g. Owner's representative.
2. Review concrete slab design for compressive strength, flatness and levelness, cold- and hot-weather concreting procedures, curing procedures, sequencing, construction joints, concrete repair procedures, concrete finishing, polished concrete appearance and aggregate exposure requirements, polished concrete mockups, and protection of polished concrete.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.
- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of product requiring color selection.
- D. Samples for Verification: Actual sample of finished products for each type of exposed color.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. An installer experienced in performing polished concrete finishing with a minimum of five previous projects similar in material, design, and extent to that indicated for this Project.
 2. Trained and certified by manufacturer of polished concrete system materials.
 3. Concrete Polishing Craftsman of the Concrete Polishing Council.
- B. Polished Concrete Standards: Comply with ACI 310.1.

1.6 MOCKUPS

- A. Build mockups 10 by 10 ft. to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 1. Build mockups in the location of the Work and of the size indicated or, if not indicated, as directed by Architect for newly placed concrete.
 2. Demonstrate surface preparation, pattern, curing, tested aggregate exposure, tested polish appearance, sealing and protecting of polished concrete.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 5. Remove rejected mockups.

1.7 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as needed for other construction activities.
- B. Ambient Conditions: Ensure installation location and Project ambient conditions comply with manufacturers written instructions.

PART 2 - PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear liquid materials for the applications of cleaning solutions, densifiers, and sealers that strengthen or protect polished concrete surfaces.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Advanced Floor Products; Retro-Plate 99 or a comparable product by one of the following:
 - a. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
 - b. Laticrete International, Inc.

2.2 POLISHED CONCRETE SURFACE FINISH REQUIREMENTS - **PC1**

- A. Aggregate Exposure Class: Class B Fine Aggregate 85 to 95 percent fine aggregate; 5 to 15 percent blend of fines and coarse aggregate.
- B. Polish Concrete Appearance Levels: Level 2: Satin (Honed) up to 200- to 400-grit polish; DOI 10 to 39; Haze Reading less than 10; Reflective Sheen: Low to medium.
- C. Slip Resistance: Minimum Dynamic Coefficient of Friction (DCOF) of 0.42. Provide required slip resistance based on final gloss level and determined by the Concrete Polishing Council.

2.3 ACCESSORIES

- A. Repair Materials: As recommended in writing by manufacturer to repair and fill cracks, and repair surfaces compatible with polishing materials.
- B. Water: Potable.
- C. Cleaning Agents: As recommended in writing by manufacturer.

2.4 POLISHING EQUIPMENT

- A. Equipment and Supplies: Provide equipment and supplies, not limited to, the concrete grinding and concrete polisher equipment, tooling and polishing diamonds for the polished concrete finishing Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that concrete substrates are acceptable for grinding, polishing and product installation as recommended by manufacturer.
- B. Do not begin Work until unsatisfactory conditions have been addressed and corrected.

3.2 PREPARATION

- A. Verify that concrete substrate preparation is in accordance with manufacturer's written instructions.
- B. Clean surfaces free of dust, dirt and other contaminants incompatible with liquids applied products and polishing.
- C. Clean and seal cracks as recommended by manufacturer.
- D. Prepare, clean and fill joints with joint filler as recommended in writing by manufacturer.
- E. Clean surface completely of any dust with cleaning solution as recommended in writing by manufacturer.

3.3 APPLICATION

- A. Machine grind floor surfaces progressively to receive aggregate and polish appearance levels indicated to match approved mockup.
- B. Apply sealers to polished concrete in polishing sequence and in accordance with manufacturers' written instructions.
- C. Continue progressively polishing to aggregate and polish appearance levels to match approved mockup for final finish appearance.
- D. Visually inspect to remove defects and repolish areas that are defective. Repolish those areas that do not meet specified aggregate and polish levels per approved mockup.
- E. Complete edges of floor finish that adjoins surrounding floor areas in a sharp and clean manner.
- F. Neutralize and clean polished floor surfaces.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests at three random locations for areas up to 100 sq. ft. and inspections and to submit reports.
- B. Measure polish specular gloss level, DOI, and haze as specified; repolish if required to achieve Project requirements.

- C. Verify aggregate exposure as specified. Machine surfaces if required to achieve Project requirements.
- D. Verify compliance of slip resistance to comply with specified slip-resistance rating.
- E. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

- A. Control and dispose of waste products produced by grinding and polishing operations.
- B. Protect installed polished concrete surfaces from damage during construction in accordance with manufacturer's written instructions.

END OF SECTION 033543

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Brick. Included for any patching and repair.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry-joint reinforcement.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
- 9.

- B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
2. Section 071900 "Water Repellents" for water repellents applied to unit masonry assemblies.
3. Section 072100 "Thermal Insulation" for cavity wall insulation.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 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. Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Brick, in the form of straps of five or more bricks.
2. Colored mortar.
3. Weep holes/cavity vents.

D. Samples for Verification: For each type and color of the following:

1. Brick, in the form of straps of five or more bricks.
2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Weep holes.
4. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. 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 according to ASTM C 67.
 - d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
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. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

D. 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 proportion specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups for each type of exposed unit masonry construction in sizes approximately 60 inches (1500 mm) long by 60 inches (1500 mm) high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches (400 mm) long in exterior wall mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
 - c. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include metal studs, sheathing, water-resistive barrier air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
 2. Clean exposed faces of mockups with masonry cleaner as indicated.
 3. Protect accepted mockups from the elements with weather-resistant membrane.
 4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. 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.

1.9 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 (600 mm) 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 (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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) according to TMS 602/ACI 530.1/ASCE 6.
 - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

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 (6 m) vertically and horizontally of a walking surface.

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 C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
 - 2. Density Classification: Light weight unless otherwise indicated.
 - 3. Size (Width): 8 by 8 by 16 inches. Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.

4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

C. Decorative CMUs: ASTM C 90.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Amcor Masonry Products.
 - b. Lehi Block.
2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as indicated in the structural drawings.
3. Density Classification: As indicated in the structural drawings.
4. Size (Width): As indicated in Drawings.
5. Pattern and Texture:
 - a. Standard pattern, ground-face finish where indicated in Drawings. Match Architect's samples.
6. Colors: As indicated by manufacturer's designations.
7. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.

2.5 CONCRETE TRIM AND MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 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 those at corners, movement joints, bond beams, sashes, and lintels.
- B. Hollow Brick: ASTM C652, Grade SW, Type HBX.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Interstate Brick; Atlas Brick.
 2. Unit Compressive Strength: Provide units with minimum gross-area compressive strength of 6000 psi.
 3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 4. Size (Actual Dimensions): Match existing.
 5. Application: Use where brick is exposed unless otherwise indicated.
 6. Color and Texture: Match existing; confirm with Architect.

2.7 MORTAR AND GROUT MATERIALS

- A. Colored Cement Products: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Masonry Cement:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
 - 2) Essroc; Brixment-in-ColorFlamingo Color Masonry Cement.
 - 3) Holcim (US) Inc; Rainbow Mortamix Custom Color Masonry Cement.
 - 4) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
 - 5) Lehigh Hanson; HeidelbergCement Group; Lehigh Custom Color Masonry Cement.
 2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 3. Pigments shall not exceed 10 percent of portland cement by weight.
 4. Pigments shall not exceed 5 percent of masonry cement by weight.
- B. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
- C. Aggregate for Grout: ASTM C 404.
- D. Water: Potable.

2.8 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
1. Interior Walls: Mill- galvanized carbon steel.
 2. Exterior Walls: Hot-dip galvanized carbon steel.
 3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
 4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
 5. Spacing of Cross Rods, Tabs, and Cross Ties: As indicated in the structural drawings.
 6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

2.9 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual," and as follows:
1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch (0.40 mm) thick.

2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
4. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Self-Adhering, Stainless Steel Fabric Flashing: Composite, flashing product consisting of 2 mil of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric with a butyl adhesive or permanent, clear adhesive, to produce an overall thickness of 10 mil.
 - 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) Hohmann & Barnard, Inc.
 - 2) Wire-Bond.
 - 3) York Manufacturing, Inc.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge unless otherwise indicated.
4. Where flashing is fully concealed, use metal flashing.

D. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B 32, Grade Sn96, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C 920, chemically curing urethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

E. 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.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity Vent Products: Use the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Building Products Inc.; Mortar Maze Cell Vent.
 - 2) Hohmann & Barnard, Inc; QV Quadro-Vent.
 - 3) Wire-Bond; Cell Vent.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advanced Building Products Inc.; Mortar Break.
 - b. CavClear/Archovations, Inc.; CavClear Masonry Mat.
 - c. Hohmann & Barnard, Inc; Mortar Trap.
 - d. Mortar Net USA, Ltd; Mortar Net.
 - e. Wire-Bond; Cavity Net.
 2. Configuration: Provide one of the following:
 - a. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail-shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.
 - b. Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

2.11 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
 - b. PROSOCO, Inc.

2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For reinforced masonry, use Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
 - 3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

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 (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) 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 (100-mm) 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 (100 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) 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 (600 mm) 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. Anchor top of partition walls to structure above as indicated in Structural Drawings.
 - 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.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and 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. Set trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
 - 4. Rake out mortar joints for pointing with sealant.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- E. Cut joints flush where indicated to receive air barriers unless otherwise indicated.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 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.

C. Form expansion joints in brick as follows:

1. Build flanges of factory-fabricated, expansion-joint units into masonry.
2. Build in compressible joint fillers where indicated.
3. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch (13 mm) for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch (10 mm).

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

E. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes 16 inches (600 mm) o.c. unless otherwise indicated.

F. Place cavity drainage material in cavities and airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

- G. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.

3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of 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 (1520 mm).

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to 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. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

- G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- H. Mortar Test (Proportion Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- J. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

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 nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

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. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Structural steel framing.
- 2. Shear stud connectors, shop welded.
- 3. Shrinkage-resistant grout.

- B. Related Requirements:

- 1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
- 2. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame and other steel items not defined as structural steel.
- 3. Section 099123 "Interior Painting" for painting requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.
- B. Lateral- Force-Resisting System: Elements of structural-steel frame designated as "LFRS" or along grid lines designated as "LFRS" on Drawings, including columns, beams, and braces and their connections.

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. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Shop primer.
5. Galvanized-steel primer.
6. Etching cleaner.
7. Galvanized repair paint.
8. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Identify members not to be shop primed.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M 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, for demand-critical welds.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator and testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural-steel materials, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.

1.8 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

1.9 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 F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 - 1. ANSI/AISC 303.
 - 2. ANSI/AISC 341.
 - 3. ANSI/AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
 - 1. Option 1: Connection designs have been completed and connections indicated on the Drawings.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: As indicated in Drawings.
- B. Channels, Angles: As indicated in Drawings.

- C. Plate and Bar: As indicated in Drawings.
- D. Cold-Formed Hollow Structural Sections: Grade as indicated in Drawings for structural tubing.
- E. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.
- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1, compressible-washer type with plain finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Plain.
- D. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 PRIMER

- A. Steel Primer:
 - 1. Fabricator's standard lead and chromate free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanized-Steel Primer: MPI#134.
 - 1. Etching Cleaner: MPI#25, for galvanized steel.
 - 2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.5 SHRINKAGE-RESISTANT GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, 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 in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing 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 standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.
- F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- H. 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.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: As indicated in General Structural Notes.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
 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 and shelf angles attached to structural-steel frame and located in exterior walls.

2.9 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 of high-strength bolted, pretensioned joints in connections that are part of the LFRS.
 5. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 6. Galvanized surfaces unless indicated to be painted.
 7. Surfaces enclosed in interior construction.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
 1. SSPC-SP 3.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

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 on Drawings.
 1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of baseplate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- 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. Slope roof framing members to slopes indicated on Drawings.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect/Structural Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
1. Joint Type: As indicated in General Structural Notes.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.
- C. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.5 REPAIR

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
1. 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.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.

- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Roof deck.

- B. Related Requirements:

- 1. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
- 2. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- B. Shop Drawings:

- 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of steel deck.

- C. Test and Evaluation Reports:

- 1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - a. Power-actuated mechanical fasteners.
- 2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

- D. Field Quality-Control Submittals:

- 1. Field quality-control reports.

- E. Qualification Statements: For welding personnel.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M and AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 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. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ROOF DECK

- 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. ASC Profiles, Inc.
 - 2. Nucor Corp.
 - 3. Verco Decking, Inc., a Nucor company.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, 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: As indicated Simple span Double span Triple span or more.
 - 6. Side Laps: Interlocking seam.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi , not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- G. Galvanizing Repair Paint: ASTM A 780/A 780M.

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 of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck where indicated in Structural Drawings. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 3/4 inch , nominal, unless indicated otherwise.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 18 inches apart, maximum, unless indicated otherwise.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches , and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds mechanical fasteners not more than 12 inches apart with at least one weld at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.

3.5 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Interior non-load-bearing wall framing.
 - 3. Soffit framing.
- B. Contractors may provide options for changes to indicated framing systems in the submittal process. Calculations for exterior soffit areas are included in deferred submittals.
- C. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
 - 2. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required and shall not be construed as an engineered design. Furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents including, but not limited to, the following:
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings, and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Coordination of Contract Documents and Work:
 - 1. Product Variations: In the event of minor differences between products and systems of available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between

products and Contract Documents shall be included in the Work at no additional cost to Owner.

2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner

1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing, fabrication, fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- D. Welding certificates.
- E. Qualification Data: For manufacturer, installer, and professional engineer.
- F. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 1. Steel sheet.
 2. Expansion anchors.
 3. Power-actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.
 6. Horizontal drift deflection clips
 7. Miscellaneous structural clips and accessories.
- G. Research/Evaluation Reports: Evidence of cold-formed metal framing's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of

cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- D. 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.
- E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. AllSteel Products, Inc.
 - 2. California Expanded Metal Products Company.
 - 3. Clark Steel Framing.
 - 4. Dietrich Metal Framing; a Worthington Industries Company.
 - 5. MarinoWare; a division of Ware Industries.
 - 6. SCAFCO Corporation.
 - 7. Steel Construction Systems.

2.2 PERFORMANCE REQUIREMENTS

- A. 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.
 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
 - b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
 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. System shall accommodate plus or minus 3/4 in differential vertical deflection of floors.
 - b. System shall accommodate plus or minus building drift as indicated in the General Structural Notes.
 - c. Maintain exterior wall design and incorporate an expansion and contraction joint located above ceiling line to isolate movement between interior and exterior finishes.
 - d. Stud depth and spacing indicated is critical for performance of other materials and shall not be changed without consideration of other materials. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- B. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
1. Wall Studs: AISI S211.
 2. Headers: AISI S212.
 3. Lateral Design: AISI S213.
- C. Thermal Movements: Engineer products and systems to accommodate thermal movements of supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade: As required by structural performance.
 2. Coating: G90 or equivalent

- B. Steel Sheet for Vertical Deflection, Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90.

2.4 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: As indicated in General Structural Notes.
 - 2. Flange Width: As indicated in General Structural Notes.
- 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: As indicated in General Structural Notes.
 - 2. Flange Width: As indicated in General Structural Notes.
- C. Rigid Clips: Manufacturer's standard bypass or head clips.
 - 1. Material: ASTM A653 (Grade 50) or ASTM A572 (Grade 50). Zinc coated by the hot-dip process according to ASTM A123.
 - 2. Thickness: Portion of clip/clip assembly attached to structure shall be a minimum 97mils.
 - 3. Attach to structure by welding with a minimum 1/8" x 3" long fillet weld each side of the clip / clip assembly (6" total weld)
 - 4. Attach to studs by welding with a minimum 1/8" fillet weld (min. 3" vertical weld and 2" horizontal weld).
 - 5. Allowable out-of-plane capacity: Clips shall have minimum of out-of-plane allowable strength of 700lb, but not less than required by analysis.
 - 6. Allowable vertical load capacity: Clips shall have minimum vertical load allowable strength of 400lb, but not less than required by analysis.
 - 7. Required Locations:
 - a. Metal studs over storefront or curtain wall that is supported vertically by the structure.
 - b. At locations vertical re-support of the metal studs.
 - 8. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.
- D. Deflection Clips: Manufacturer's standard bypass or head clips.
 - 1. Material: ASTM A653 (Grade 50) or ASTM A572 (Grade 50). Zinc coated by the hot-dip process according to ASTM A123.
 - 2. Thickness: Portion of clip/clip assembly attached to structure shall be a minimum 97mils.
 - 3. Attach to structure by welding with a minimum 1/8" x 3" long fillet weld each side of the clip / clip assembly (6" total weld).

4. Attach to studs by welding with a minimum 1/8" fillet weld (min. 3" vertical weld and 2" horizontal weld).
 5. Vertical Movement: Clip shall be capable of providing 1-1/2" of vertical downward movement.
 6. Allowable out-of-plane capacity: Clips shall have minimum of out-of-plane allowable strength of 700lb, but not less than required by analysis.
 7. Required Locations:
 - a. Where indicated on drawings.
 8. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.
- E. Drift Clips:
1. Material: ASTM A653 (Grade 50) or ASTM A572 (Grade 50). Zinc coated by the hot-dip process according to ASTM A123.
 2. Thickness: Portion of clip/clip assembly attached to structure shall be a minimum 97mils.
 3. Attach to structure using minimum 2-#12 self-tapping self-drilling screws. Screws placed in slots intended for horizontal or vertical movement shall have step bushings or washers to allow clip to slide freely after installation. Provide additional fasteners as required by analysis.
 4. Vertical Movement: Clip shall be capable of providing 1-1/2" of vertical downward movement.
 5. Horizontal In-Plane Movement: Clip shall be capable of providing horizontal in-plane movement in both directions equal to the building story drift.
 6. Allowable out-of-plane capacity: Clips shall have minimum of out-of-plane allowable strength of 700lb, but not less than required by analysis.
 7. Required Locations:
 - a. All exterior metal stud connections excluding the following:
 - 1) Metal studs over storefront or curtain wall that is supported vertically by the structure.
 - 2) Framing between king studs at punched openings. Do-not use any clips to attach in-fill studs at these locations – if a clip is needed for construction method chosen by the contractor, or for load requirements, drift clips shall be used.
 - 3) At locations vertical re-support of the metal studs.
 8. At king studs each side of punched openings a minimum of 2 clips shall be used for openings larger than 3'-0", or as required by analysis.
 9. Design Standard: DSLB Drift Clip by The Steel Network for bypass clips, DSL Drift Clip by The Steel Network for head of wall clips.
- F. 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: As indicated in General Structural Notes.
 2. Flange Width: As indicated in General Structural Notes.
- G. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0538 inch.
 - b. Flange Width: 1 inch.
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0538 inch.
 - b. Flange Width: Sum of outer deflection track flange width plus 1 inch.

2.5 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. Flange Width: 1-5/8 inches.
 3. Refer to General Structural Notes for additional requirements.
- 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: 0.0329 inch.
 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- 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: 0.0428 inch.
 2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
- 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: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch.

- b. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch.
 - b. Flange Width: Dimension equal to sum of outer deflection track flange width plus 1 inch.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 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.
 - 3. Refer to General Structural Notes for additional requirements.

2.7 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. Stud kickers and knee braces and girts.
 - 8. Hole-reinforcing plates.
 - 9. Backer plates and straps.

2.8 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 36 Grade 55, threaded carbon-steel hex-headed bolts, headless, hooked bolts, headless bolts, with encased end threaded, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by mechanically deposition according to ASTM B695, Class 50.
- 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 AC01, ICC-ES AC193, ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
 2. Type: Torque-controlled expansion anchor.
 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency. Power actuated fasteners are not permitted for use in tension Load applications. Anchors shall be approved for use in seismic design category D by ICC ES. At attachments to concrete elements, concrete shall be considered "cracked concrete" for anchor design.
- E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B or SSPC-Paint 20.
- B. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- D. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.10 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 shall not 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. 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.
- B. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

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.

3.4 INSTALLATION OF EXTERIOR 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. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
 - 3. 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 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.

3.5 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: 16 inches.
- 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.
 5. Do not attach bridging to roof deck.
- 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 48-centers minimum or less as 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 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 shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 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.

3.8 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 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

SECTION 055000 - METAL FABRICATIONS

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. Steel framing and supports for floor and ceiling-anchored toilet compartments.
2. Steel framing and supports for operable partitions.
3. Steel framing and supports for overhead doors.
4. Steel framing and supports for countertops.
5. Steel framing and supports for mechanical and electrical equipment.
6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
7. Metal ships' ladders.
8. Metal bollards.
9. Loose bearing and leveling plates for applications where they are not specified in other Sections.

- B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, and slotted-channel inserts indicated to be cast into concrete.

- C. Related Requirements:

1. Section 042000 "Unit Masonry" for installing anchor bolts, and other items built into unit masonry.
2. Section 051200 "Structural Steel Framing" for steel framing, supports, door frames, and other steel items attached to the structural-steel framing.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Fasteners.
3. Shop primers.
4. Shrinkage-resisting grout.
5. Slotted channel framing.
6. Metal ships' ladders.
7. Metal bollards.

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. Steel framing and supports for floor and ceiling-anchored toilet compartments.
2. Steel framing and supports for operable partitions.
3. Steel framing and supports for overhead doors.
4. Steel framing and supports for countertops.
5. Steel framing and supports for mechanical and electrical equipment.
6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
7. Metal ships' ladders.
8. Metal bollards.

C. Samples for Verification: For each type and finish of extruded tread.

D. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 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. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research Reports: For post-installed anchors.

1.6 CLOSEOUT SUBMITTAL

A. Maintenance Data: Written instructions for maintenance of ladder cable fall arrest system.

1.7 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.8 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. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 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. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 - 2. Material: Galvanized steel, ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.
 - 3. Material: Cold-rolled steel, ASTM A1008/A1008M, structural steel, Grade 33 ; 0.0966-inch minimum thickness; hot-dip galvanized after fabrication.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. 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.
- D. 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.
- E. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical 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.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- G. 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" and Section 099123 "Interior 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. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

- G. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. 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. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 METAL SHIPS' LADDERS

- A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
 - 1. Treads shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, and riser height shall be not more than 9-1/2 inches.
 - 2. Fabricate ships' ladders, including railings from steel.
 - 3. Fabricate treads from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1/2 inch in least dimension.
 - 4. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."
- B. Galvanize exterior steel ships' ladders, including treads, railings, brackets, and fasteners.
- C. Prime steel ships' ladders, including treads, railings, brackets, and fasteners, with zinc-rich primer.

2.8 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize and prime exterior miscellaneous steel trim.

- D. Prime miscellaneous steel trim with zinc-rich primer.

2.9 METAL BOLLARDS

- A. Fabricate metal bollards from 6 inch diameter, Schedule 40 steel pipe. Verify pipe does not exceed maximum allowed by bollard cover.
- B. Prime steel bollards with zinc-rich primer.
- C. Bollard Cover:
 - 1. Basis-of-Design Product: Provide Reliance Foundry Co. Ltd.; R-7305 cover or comparable cover approved prior to bidding.
 - 2. Height: 36 inches.
 - 3. Diameter: 8 5/8 inches.
 - 4. Max interior post size:
 - a. Height: 34 inches.
 - b. Diameter: 6 5/8 inches.
 - 5. Design: Cylindrical bollard cover with rounded top.
 - 6. Material: Stainless steel: ASTM A312, Grade TP 316.
 - 7. Finish: Satin No. 6, buffed.
 - 8. Installation: Security post cover, new, set screws.

2.10 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. Prime plates with zinc-rich primer.

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. 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 floor and ceiling anchored toilet partitions, operable partitions and overhead doors securely to, and rigidly brace from, building structure.

3.3 INSTALLATION OF METAL BOLLARDS

- A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
 - 1. Set bollards at maximum height allowed by bollard cover.
- B. At bollards without metal caps, fill bollards solidly with concrete.

3.4 INSTALLATION OF 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.

3.5 INSTALLATION OF METAL SHIPS' LADDERS

- A. Secure top and bottom of ships' ladders to construction to comply with manufacturer's written instructions.

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.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

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. Steel railings.
2. Stainless steel railings.

- B. Related Requirements:

1. Section 099123 "Interior Painting" for field application of paint finish.

1.3 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 anchorages for railings. 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.

1.4 ACTION SUBMITTALS

- A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Fasteners.
3. Post-installed anchors.
4. Handrail brackets.
5. Shop primer.
6. Bituminous paint.
7. Nonshrink, nonmetallic grout.
8. Metal finishes.
9. Paint products.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

- C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
 2. Fittings and brackets.
 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of connecting and finishing members at intersections.
- D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For delegated-design professional engineer.
- B. Welding certificates.
- C. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- F. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. 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.
- C. 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, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.
- C. Fabricators: Provide custom railings, fabricated by, but not limited to, one of the following:
 - 1. Arc n' Spark Design and Fabrication.
 - 2. Green's Welding.

2.3 STEEL RAILINGS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.
- C. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.

- D. Plates, Shapes, and Bars: ASTM A36/A36M.

2.4 STAINLESS STEEL RAILINGS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Exterior Railings:
 - 1. Tubing: ASTM A554, Grade MT 316L.
 - 2. Pipe: ASTM A312/A312M, Grade TP 316L.
 - 3. Castings: ASTM A743/A743M, Grade CF 8M or CF 3M.
 - 4. Plate and Sheet: ASTM A240/A240M or ASTM A666, Type 316L.

2.5 FASTENERS

- A. Fastener Materials:
 - 1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941, Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
 - 3. Stainless Steel Railing Components: Type 304 (at interior railings), Type 316 (at exterior railings) stainless steel fasteners.
 - 4. Finish exposed fasteners to match appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - 2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
 - 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. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.6 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast stainless steel, center of handrail 2-1/2 inches from wall.

- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
 - 1. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting."
- F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- G. Intermediate Coats and Topcoats: Provide products that comply with Section 099123 "Interior Painting."
- H. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.
- I. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- 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 work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint
- I. Form changes in direction as follows:
 - 1. By bending to smallest radius that will not result in distortion of railing member.
- J. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.
- O. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- P. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.8 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize indicated steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.

4. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
- D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3.
- E. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 1. Shop prime uncoated railings with primers specified in Section 099123 "Interior Painting" unless zinc-rich primer is indicated.
 2. Do not apply primer to galvanized surfaces.

2.9 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 1. Run grain with long dimension of each piece.
 2. When polishing is completed, passivate and rinse surfaces.
 3. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Stainless Steel Pipe and Tubing Finishes:
 1. 180-Grit Polished Finish: Uniform, directionally textured finish.
- D. Stainless Steel Sheet and Plate Finishes:
 1. Directional Satin Finish: ASTM A480/A480, No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of same metal as post, attached to post with setscrews.

3.5 ATTACHING RAILINGS

- A. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

- B. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.6 REPAIR

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

3.7 CLEANING

- A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Wood blocking and nailers.
 - 2. Plywood backing panels.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for sheathing.

1.3 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Power-driven fasteners.
 - 4. Post-installed anchors.

1.6 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, GENERAL

- A. Lumber: 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. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWA 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. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall 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 according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 1. Treatment shall not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- 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.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat all rough carpentry unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 1. Blocking.
 2. Nailers.
 3. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 Standard, Stud, or No. 3 grade lumber of any species. any of the following species: the following species:

- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, grounds, 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. 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.
 - E. 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.
 - F. Comply with AWPA 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.
 - G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
 - H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 2. ICC-ES evaluation report for fastener.
 - I. 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.
 - J. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 1. Comply with approved fastener patterns where applicable.
 2. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.
- 3.2 WOOD BLOCKING, AND NAILER INSTALLATION
- 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 items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- 3.3 PROTECTION
- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 – SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Wall sheathing.
- 2. Parapet sheathing.
- 3. Sheathing joint and penetration treatment.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for plywood backing panels.
- 2. Section 072100 "Thermal Insulation" for combination insulation and air barrier.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

- 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
- 2. 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 according to ASTM D5516.

- 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Fire-retardant-treated plywood.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack 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 according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
 - d. USG Corporation.
 - 2. Type and Thickness: Type X, 5/8 inch thick.
 - 3. Size: 48 by 96 inches for horizontal installation.

2.3 PARAPET SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
 - d. USG Corporation.
 2. Type and Thickness: Type X, 5/8 inch thick.
 3. Size: 48 by 96 inches for horizontal installation.

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. For parapet and wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. 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 less than 0.0329 inch thick, use screws that comply with ASTM C1002.
 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

2.5 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.
- B. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.
- D. Coordinate wall and parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. 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 GYPSUM SHEATHING

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. 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. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. 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 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.

END OF SECTION 061600

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Plastic-laminate-clad architectural cabinets.
 - 2. Plywood wall panels.
 - 3. Wall mounted adjustable shelving.
 - 4. Solid surface countertops and windowsills.
 - 5. 3D thermoplastic laminate panels for wall applications.
 - 6. Wood panels for wall applications.
 - 7. Acrylic resin panels.
 - 8. Concealed brackets for countertops specified in Division 6 and Division 12.
- B. Related Sections include the following:
 - 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, required for installing woodwork.
 - 2. Section 123616 "Metal Countertops" for stainless steel tops.
 - 3. Section 123623.13 "Plastic-Laminate-Clad Countertops" for plastic laminated tops.
 - 4. Section 123653 "Laboratory Worksurfaces" for epoxy resin tops.
 - 5. Section 123661.19 "Quartz Agglomerate Countertops" for quartz tops.

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

- A. Product Data: For multi core panel products, plywood, high-pressure decorative laminate, adhesive for bonding plastic laminate, thermoset decorative overlay, 3D thermoplastic laminate panels, wood panels, and cabinet hardware and accessories.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for fixtures and other items installed in architectural woodwork.

- C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
 - 1. Plastic laminates.
 - 2. Thermoset polyester overlays.
 - 3. Solid-surfacing materials, 6 inches square.
- D. Samples for Verification: For the following:
 - 1. Plastic-laminate-clad panel products, 8 by 10 inches, for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
 - 2. Thermoset polyester-overlay surfaced panel products, 8 by 10 inches, for each type, color, pattern, and surface finish.
 - 3. Lumber with or for transparent finish, 5 inches wide by 24 inches long, for each species and cut, finished on 1 side and 1 edge.
 - 4. Exposed cabinet hardware and accessories, one unit for each type and finish.
 - 5. Adjustable shelving standards.
 - 6. Solid-surfacing materials.
 - 7. Panels applied to walls.
- E. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 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
- B. Installer Qualifications: An experienced installer who has completed architectural woodwork 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.
- C. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork
- E. Quality Standard: Unless otherwise indicated, comply with NAAWS 4.0 "North American Woodwork Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
- F. Preinstallation Conference: Conduct conference at Project Site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.
- B. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule Scheduled by Describing Products to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS

- A. Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by one of the following:
 - 1. Artistic Mill.
 - 2. Granite Mill and Fixture Company.
 - 3. Huetter Mill and Cabinet Company.
 - 4. Johnson Brothers, Inc.
 - 5. MapleLeaf Cabinets.
 - 6. Pacific Cabinets.
 - 7. Swainston Mill, Preston ID.
 - 8. TMI Systems.

- B. Other fabricators: Submit request for approval prior to bid.

2.2 MATERIALS

- A. General: Provide materials that comply with requirements of the NAAWS quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
 - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- 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. Hardboard: AHA A135.4.
 - 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
 - 3. Softwood Plywood: DOC PS 1, Medium Density Overlay.
- C. Core Material at Drawer Fronts and Doors: Provide the following (particle board cores are not acceptable):
 - 1. Combination softwood plywood veneer core interior laminated with MDF crossbands front and back.
 - 2. Available Products: Subject to compliance with requirements, combination veneer core plywood products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Columbia Forest Products, "Classic Core."
 - b. Roseburg, "Skyply CFC Core".
 - c. States Industries, "Armorcore."
 - d. Timber Products Company, "Pro-Core MDF".
- D. Core Material at Exposed and Semi Exposed Surfaces: Provide the following at cabinet body tops, bottoms, shelves, end panels and other exposed and semi exposed surfaces unless noted otherwise (particle board cores are not acceptable):
 - 1. Softwood plywood veneer core.
 - 2. Available Products: Subject to compliance with requirements, veneer core plywood products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Columbia Forest Products, "Purebond Veneer Core."
 - b. Roseburg, "Skyply Veneer Core".
 - c. States Industries, "Veneer Core".
 - d. Timber Products Company, "Veneer Core".
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
 - a. Abet Laminati Inc.
 - b. Arborite.
 - c. Formica Corporation.
 - d. Lamin-Art, Inc.
 - e. Pionite: Panolam Industries International, Inc.
 - f. Wilsonart.

- F. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a pre-coated finish.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering solid surfacing materials that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avonite Surfaces.
 - b. E.I. Du Pont De Nemours and Company.
 - c. Formica Corporation.
 - d. LG chemical, LTD.
 - e. Samsung Chemical USA, Inc.
 - f. Wilsonart.
 - 2. Solid-Surfacing-Material Thickness: 1/2-inch.
 - 3. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
 - a. Match product indicated in the Finish Schedule.
 - 4. Fabricate sills in one piece with shop-applied edges, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Millwork Base: Refer to Section 064219 "Plastic-Laminate-Faced Wood Paneling."

2.4 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Concealed Brackets: Basis-of-Design Product: Provide A&M Hardware, Inc.; 2.0" Concealed Brackets or comparable product.
 - 1. Size and Arm Length: As required to support the depth of the countertop.
 - 2. Maximum Spacing: 32 inches o.c.

2.5 PLASTIC-LAMINATE CABINETS

- A. Quality Standard: Comply with NAAWS 4.0, Section 10 requirements for laminate cabinets.
- B. Grade: Premium.
- C. Type of Construction: Frameless.

- D. Door and Drawer Front Style: Flush overlay.
- E. Panel Thickness:
 - 1. Cabinet Bodies: 3/4 inch minimum, unless indicated otherwise.
 - 2. Cabinet Backs at Bodies Installed at Walls, Unexposed: 1/4 inch.
 - 3. Doors and Drawer Fronts: 3/4 inch for all hinged and sliding doors.
- F. Drawer Box Sides, Back and Sub-fronts: 3/4 inch.
 - 1. Drawer Bottom: 1/4 inch hardboard.
 - 2. Shelves: 1-inch for shelves up to 35 inches in width, and 1-1/4 inches thick for shelves over 35 inches in width.
- G. Laminate Cladding for Exposed Surfaces: Laminate cladding complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops Unless Noted Otherwise: HPDL, Grade HGS.
 - 2. Vertical Surfaces: HPDL, Grade HGS.
 - 3. Cabinet Tops: Thermally Fused Laminate where cabinet top is 7'-0" above finished floor or higher. HPDL, Grade HGS at other cabinets not covered with a countertop.
 - 4. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
 - 5. Doors and Drawer Fronts: Provide indicated laminate cladding on both faces.
- H. Laminate Cladding for Semi Exposed Surfaces: Laminate cladding complying with the following requirements:
 - 1. Interior Cabinet Body Surfaces and Shelves (unless noted otherwise): Thermally fused laminate panels.
 - 2. Edges of Thermally Fused Laminate Panel Shelves: PVC or polyester edge banding, 3 mm thick minimum.
 - 3. Cabinet Body Back and end Panels with Exposed HPDL Surfaces: HPDL, Grade VGS.
 - 4. Drawer Box Sides, Back and Sub-Fronts: Thermally fused laminate panels with 1 mm thick PVC edge banding.
 - 5. Drawer Bottom: Thermally fused laminate panel.
- I. Component Construction:
 - 1. Toe Kicks: Fixed cabinet bases, constructed of 3/4 inch, moisture resistant MDF with 2-by fir stringers, ripped to provide 4 inch high base. Level bases and anchor to the floor in continuing lengths to ensure straight and true lines of casework. Scheduled resilient or tile base shall be provided as indicated at respective Division 9 sections.
 - 2. Adjustable Shelves:
 - a. All shelves to be adjustable on 2 inch centers.
 - b. Provide a center, fixed shelf at cabinets taller than 72 inches.
 - 3. Drawers:
 - a. Paper storage drawers shall be fitted with a hood at back for paper retainage, and shall have a 1/2-inch thick reinforced bottom.
 - b. Drawer fronts shall be mounted with an adjusting mechanism to allow full adjustability and alignment in field.
 - c. Drawer bottom shall be recessed into box sides, back and front.
 - 4. Vertical and Horizontal Dividers:
 - a. Vertical and horizontal dividers shall be 1/4-inch tempered hardboard smooth both sides or 3/4-inch TFL panels.
- 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 samples selected from full range of Manufacturers products. Selections may be considered above standard grade for manufacturers with multi-tiered pricing.
 - 2. Colors may not be standard with some manufacturers.

3. Edge Banding: Match laminate color unless other colors are approved by Architect.

2.6 PLYWOOD WALL PANELS - **PW**

- A. Plywood wall finish mounted to substrate as indicated on Drawings:
 1. Softwood Plywood: DOC PS 1.
 2. Grade: APA A-C, Group 1, Exposure 1.
 3. Thickness: 3/4 inch.
 4. Finish: System 12 – Polyurethane, Water Based. Comply with balance of requirements specified in Shop Finishing article.
- B. Trim, Fabrication and Installation:
 1. Provide aluminum trim at plywood panels, shapes as indicated in Drawings.
 2. Refer to Section 064219 “Plastic-Laminate-Faced Wood Paneling” for edge and corner trim, trim finish, fabrication and installation requirements.

2.7 SOLID SURFACING FABRICATION (at Countertops and Windowsills) - **SS1**

- A. Quality Standard: Comply with NAAWS 4.0, Section 11 requirements for countertops.
 1. Premium Grade
- B. Products: Subject to compliance with requirements, including color and pattern, products are limited to the following:
 1. Wilsonart.
 2. Avonite Surfaces.
 3. E.I. Du Pont De Nemours and Company.
 4. Formica Corporation.
 5. LG chemical, LTD.
 6. Samsung Chemical USA, Inc.
- C. Solid-Surfacing-Material Thickness: 1/2-inch, unless noted otherwise.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
 1. Match product indicated in the Finish Schedule.
- E. Fabricate countertops with eased edge and radiused corners.
- F. Fabricate sills in one piece with shop-applied edges, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

2.8 ADJUSTABLE WALL MOUNTED SHELVING

- A. Exposed Shelving: Made from specified core material, 3/4 inch thick with thermally fused laminate on both faces and continuous 3 mm thick PVC edging.
 1. Core: Indicated.
 2. Shelf Brackets: double slot brackets.
 3. Standards: Powder-coat-finished steel.

2.9 3D-THERMOPLASTIC LAMINATE PANELS – WP1

- A. General: Panels consist of a substrate that is routed to the three dimensional patterns, by computer-controlled routers, to which a thermoplastic laminate is applied with a heat activated adhesive via vacuum and positive pressure.
- B. Products: Subject to compliance with requirements, products that may be incorporated in the project include, but are not limited to:
 - 1. Soelberg Industries.
- C. Panel Characteristics:
 - 1. Core: MDF and as required for Fire Performance Characteristics.
 - 2. Patterns: As indicated in the Finish Schedule.
 - 3. Thickness: As required by the pattern and the method of attachment.
 - 4. Adhesive: Polyurethane dispersion.
- D. Fire Performance Characteristics: Provide wall panels fabricated from fire rated materials tested in accordance with ASTM-E84
 - 1. Flame spread 25 or less.
 - 2. Smoke developed: 150 or less.
- E. Warranty: Manufacturer's standard 5-year warranty.

2.10 WOOD PANELS – WP2

- A. General: Panels are milled wood in pattern indicated in the Finish Schedule Legend.
- B. Products: Subject to compliance with requirements, products that may be incorporated in the project include, but are not limited to:
 - 1. Materials; Tambora.
- C. Panel Characteristics:
 - 1. Panel Size: 48 by 96 inches.
 - 2. Wood Species: As indicated in the Finish Schedule Legend.
 - 3. Orientation: As indicated in the Finish Schedule Legend.
- D. Finish: Shop finished.

2.11 ACRYLIC RESIN PANELS

- A. Basis of Design Product: Subject to compliance with requirements, provide Lumicor, Inc.; Lumiclear acrylic resin panels or a comparable product from another manufacturer approved prior to bidding.
- B. Material:
 - 1. Acrylic resing.
 - 2. Thickness: 1/4 inch.
 - 3. Finish: Gloss.
- C. Material Properties:
 - 1. Light Transmission: 92 percent minimum through clear resin panel.
 - 2. Resin will not yellow or degrade with exposure to sunlight

3. Tensile Strength: 11,000 psi minimum, ASTM D638.
4. Tensile Modulus: 490,000 psi minimum, ASTM D638
5. Rate of Burning: CC2, ASTM D635.
6. Certified Recycled Content: 50 percent minimum Post Industrial.

- D. Tolerances:
1. Flatness: 1/16 inch maximum deviation over 12 inches.
 2. Thickness: 10 percent plus or minus.
 3. Height and Width: 1/2 inch plus or minus.
 4. Cut to sizes indicated in Drawings and edge sealed.

2.12 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Premium grade interior woodwork complying with the referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
1. Ease edges to radius indicated for the following:
 - a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
- D. Complete fabrication, including assembly, application of high pressure laminate finish, and hardware application, to maximum extent possible, before shipment to Project site.
1. Disassemble components only as necessary for shipment and installation.
 2. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
 - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
 - b. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- E. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
- F. Acrylic Resin Panels: Comply with manufacturer's written recommendation for fabrication.

2.13 SHOP FINISHING

- A. Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with NAAWS 4.0, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.

- C. Transparent Finish:
 - 1. Architectural Woodwork Standards Grade: Premium.
 - 2. Finish: System - 11, Polyurethane, Catalyzed.
 - 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - 4. Staining: None.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.
- C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.
- D. Remove adhered inventory control labels from adjustable wall shelving standards if present, including adhesive residue, to completely expose factory painted finish.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with NAAWS 4.0 Section 14 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- D. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish, toggle bolts through backing or framing behind wall finish.
- E. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
 - 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.

- F. Concealed Brackets: Install per manufacturer's written instructions. Provide blocking at metal stud walls and coordinated with wall installation.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 - 3. Caulk space between backsplash and wall with sealant specified in Section "Joint Sealants."
- H. Acrylic Resin Panels: Comply with manufacturer's written instructions.
 - 1. Material that is chipped, warped, hazed or discolored as a result of fabrication or installation will be rejected.
 - 2. Fabricate without seams, except where panel sizes exceed manufacturer's maximum panel dimensions, then coordinate seam locations with Architect and comply with manufacturer's procedures for forming field joints.

3.3 REPAIR

- A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.
- B. Where not possible to repair, replace defective woodwork.
- C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.
 - 1. Fill nail holes with matching filler where exposed.
 - 2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

3.4 CLEANING

- A. Clean interior architectural woodwork on exposed and semiexposed surfaces.
- B. Clean manufactured woodwork components (laminates, solid surface material, acrylic resin panels, etc.) as recommended by manufacturers.

3.5 HARDWARE AND ACCESSORY SCHEDULE

- A. The following items are identified by manufacturer in order to establish quality standards and functional intent. Other manufacturers are acceptable provided their products are comparable (as judged by the Architect) to those specified.
- B. Keying: All locks keyed alike in each classroom, with no classrooms keyed the same, and with a master key for the building.

- C. Schedule:
1. Hinges: Blum 170 with mounting plate
 - a. Location: Swing doors.
 2. Catches:
 - a. All Cabinets except Locking: Roller catch, ANSI/BHMA A156.9, B03071.
 - b. Locking Cabinets: Elbow catch, ANSI/BHMA A156.9, B33023.
 3. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads.
 - a. Box Drawer Slides: 100 lbf.
 - b. File Drawer Slides: 150 lbf.
 - c. Pencil Drawer Slides: 45 lbf.
 - d. Keyboard Slide: 75 lbf.
 4. Drawer Hanging File System: Hafele Hanging File System.
 - a. Location: File Drawers.
 5. Shelf Rests: ANSI/BHMA A156.9, B04013; metal, 5 mm.
 6. Pulls: 3-1/2 inch center to center wire pulls; EPCO, Futaba or Rockford Process Control (RPC)
 - a. Location: Drawers and swinging doors.
 7. Grommets for Cable Passage through Countertops: 2-1/2, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - a. Product: "OG series" by Doug Mockett and Co., Inc.
 - b. Location: Countertops and work surfaces where indicated.
 8. Door and Drawer Locks: Olympus Lock, Inc. or comparable.
 - a. 5-pin tumbler, complying with ANSI/BHMA A156.11, Grade 1.
 - b. Finish: Satin Chrome: 26D
 - c. Drawer Locks: 200W.
 - d. Door Locks: 100DR.
 - e. Master key according to owner's key schedule.
 9. Adjustable Shelf Support Rests: KV 346, 5 mm.
 - a. Location: Shelves in casework
 10. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - a. Satin Stainless Steel: BHMA 630.
 11. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

END OF SECTION 064023

SECTION 064219 - PLASTIC-LAMINATE-FACED WOOD PANELING

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. Plastic-laminate-faced wood paneling.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing paneling that is concealed within other construction before paneling installation.

1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 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: For plastic-laminate-faced wood paneling.

- 1. Include plans, elevations, sections, and attachment details.
- 2. Show details full size.
- 3. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.

- C. Samples for Initial Selection:

- 1. For each type of plastic laminate.

2. For each type of trim and finish.

D. Samples for Verification: For each type of exposed laminate, 8 by 10 inches.

1. Provide one Sample applied to core material and with specified edge material applied to one edge.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of product.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups of typical paneling as shown on Drawings.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver paneling until painting and similar operations that might damage paneling have been completed in installation areas. Store paneling 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 paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain 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 paneling is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.

- C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is 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 PANELING FABRICATORS

- A. Fabricators: Subject to compliance with requirements, provide products by one of the following:
 - 1. The fabricators listed in Section 064023 "Interior Architectural Woodwork."

2.2 PANELING, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-faced wood paneling (decorative laminate surfacing) indicated for construction, finishes, installation, and other requirements.

2.3 PLASTIC-LAMINATE-FACED WOOD PANELING

- A. Grade: Premium.
- B. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3 and the following requirements:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Abet Laminati Inc.
 - b. Arborite.
 - c. Formica Corporation.
 - d. Lamin-Art, Inc.
 - e. Wilsonart LLC.
 - 2. Faces: Grade HGS.
 - 3. Backs: Grade BKV.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:
 - 1. As indicated by Finish Schedule and manufacturer's designations.
- D. Panel Core: Fire-retardant MDF.
 - 1. Thickness: 3/4 inch.
- E. Exposed Panel Edges: Aluminum edge trim and reveals.
- F. Fire-Retardant-Treated Paneling: Panels shall consist of fire-retardant plastic laminate and medium-density fiberboard (MDF). Panels shall have a flame-spread index of 75 or less and a smoke-developed index of 450 or less per ASTM E84, and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

- G. Assemble panels by gluing and concealed fastening, unless otherwise shown.

2.4 MATERIALS

- A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
- B. Wood Moisture Content: 5 to 10 percent.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
 - 1. MDF: ANSI A208.2, Grade 130.
- E. Aluminum Trim: 6063T5 extruded aluminum profiles as indicated in Drawings.
 - 1. Basis of Design Product: Fry Reglet. or comparable product.
 - 2. Edge and Corner Trim: Millwork 1/4" Post, Millwork channel L, Millwork Corner Key, Millwork Base and other profiles as indicated in Drawings.
 - 3. Finish: Manufacturer's powder coat.
 - a. Colors: As selected by architect from manufacturer's full range.

2.5 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
 - 1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
 - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E84.
 - 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. Roseburg.

2.6 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood 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.
- C. Installation Adhesive: Product recommended by panel fabricator for each substrate for secure anchorage.
 - 1. Verify adhesives have a VOC content of 70 g/L or less.

2.7 FABRICATION

- A. Complete fabrication, including assembly, 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. Notify Architect seven days in advance of the dates and times paneling fabrication will be complete.
- B. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition paneling to humidity conditions in installation areas.
- B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install paneling to comply with quality standard grade of paneling to be installed.
- B. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
 - 1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch .

- C. Anchor paneling to supporting substrate with concealed panel-hanger clips . Do not use face fastening.
- D. Install metal trim per manufacturer's written instructions.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective paneling and trim, where possible, to eliminate defects. Where not possible to repair, replace paneling and trim. Adjust for uniform appearance.
- B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064219

SECTION 071900 - WATER REPELLENTS

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 anti-graffiti water-repellent treatments for the following interior and exterior vertical surfaces:
 - 1. Concrete unit masonry.
- B. Related Requirements:
 - 1. Low VOC coatings complying with Utah Administrative Code R307-361 are required as part of the work of this Section.

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 manufacturer's printed statement of VOC content.
 - 2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.
- B. Samples: For each type of water repellent and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Applicator.
- B. Product Certificates: For each type of water repellent.
- C. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.
- B. Mockups: Prepare mockups of each required water repellent on each type of substrate required to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Locate mockups in locations that enable viewing under same conditions as the completed Work.
 - a. Size: 10 sq. ft. each.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
 - 1. Concrete surfaces and mortar have cured for not less than 28 days.
 - 2. Building has been closed in for not less than 30 days before treating wall assemblies.
 - 3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
 - 4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
 - 5. Rain or snow is not predicted within 24 hours.
 - 6. Not less than 24 hours have passed since surfaces were last wet.
 - 7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

1.9 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. Water Repellent Treatments: 5 percent, but not less than 1 gal. of each material applied.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance: Water repellents shall meet the following performance requirements as determined by preconstruction testing on manufacturer's standard substrates representing those indicated for this Project.
- B. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:
 - 1. Concrete Masonry Units: ASTM C 140.
- C. Water-Vapor Transmission: Comply with one or both of the following:
 - 1. Maximum 10 percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E 96/E 96M.
 - 2. Minimum 80 percent water-vapor transmission of treated compared to untreated specimens, according to ASTM D 1653.
- D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E 514/E 514M.
- E. Durability: Maximum 5 percent loss of water-repellent performance after 2500 hours of weathering according to ASTM G 154 compared to water-repellent-treated specimens before weathering.

2.2 EXTERIOR PENETRATING WATER REPELLENTS

- A. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 100 g/L or less of VOCs.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Rainguard Products Company; Blok-Lok with Graffiti Control or comparable product by one of the following:
 - a. BASF Corporation.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. Laticrete International, Inc.
 - d. Pecora Corporation.
 - e. PROSOCO, Inc.
 - f. Sika Corporation.
 - g. Tamms; a brand of Euclid Chemical Company; an RPM Company.
 - h. Tnemec Inc.
 - 2. Application Rate: Apply at the following rates of coverage, unless otherwise recommended by the manufacturer for the substrate:
 - a. Concrete Masonry: 40-70sq. ft. per gallon.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 - 1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations for each 100 lineal feet of wall, by method recommended by manufacturer.
 - 2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 - 3. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.
- C. Use Rilem Tube test to determine water repellency of wall prior to, and upon completion of the anti-graffiti coating.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.
- B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:
 - 1. Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E 1857.
- C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.
- D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 - 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
 - 1. Utilize Rilem Tube testing before and after application to establish protection provided by product application in accordance with warranty requirements as specified. Record results and report to Architect.
 - a. Unless otherwise permitted by manufacturer, testing by manufacturer's representative shall be scheduled within 24 hours after application to permit additional coats if required prior to final cure of repellent system.
 - b. Requirements for warranty shall be measured penetration in Rilem Tube test in a 20 minute period with a hydrostatic head pressure equal to 60 mph wind
- B. Apply coating of water repellent on surfaces to be treated using 15 psi- pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
- C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

- A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
 - 1. Owner will engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
 - 3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect.
- B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.
 - 1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
 - 2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.
- B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071900

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Polyisocyanurate foam-plastic board.

- B. Related Requirements:

- 1. Section 072119 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.
 - 2. Section 075419 "Polyvinyl-Chloride (PVC) Roofing" for insulation specified as part of roofing construction.
 - 3. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than 25 and 450 when tested in accordance with ASTM E84.
- B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; 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 listings of another qualified testing agency.
- C. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- D. Thermal-Resistance Value (R-Value): R-value as indicated on Drawings in accordance with ASTM C518.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

- A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 or 2, taped or fluid sealed to provide an air and water resistive barrier.
 1. Application: Where indicated on Drawings to have an integral air or water resistant barrier.
 2. 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. Carlisle Coatings & Waterproofing Inc.
 - b. Dow Chemical Company (The).
 - c. Dupont De Nemours, Inc.
 - d. Firestone Building Products.
 - e. Hunter Panels.
 - f. Johns Manville; a Berkshire Hathaway company.
 - g. Rmax, Inc.
 3. Air-Barrier Assemblies: Tested as a component of a water-resistant barrier and ABAA Evaluated Air Barrier System.
 - a. Properties:
 - 1) Compressive Strength: 25 psi, ASTM D1621.
 - 2) Air Permeance: less than 0.02 L/(s.m²), ASTM E2178.
 - 3) Water Vapor Permeance: less than 0.04 perm, ASTM E96.

- 4) Water Absorption: less than 0.2% by volume, ASTM C209.

2.3 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, 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.

B. Accessories for Water Resistive and Air Barrier Installations:

1. Insulation Fasteners for Metal Framing:

- a. Corrosion-resistant self-tapping screws with 1" diameter cap or washer and 1 inch minimum framing embedment.
- b. Fastener Spacing: 12 inch centers at perimeter; 12 inch centers in field.

2. Flashing Tape:

- a. Provide insulation manufacturer's recommended tape for counter-flashing and penetrations through the insulation layer.
- b. Provide 9 inch wide minimum flashing tape at head, sill and jambs of openings.

3. Seam Tape:

- a. Provide manufacturer's 2-1/2 inch wide seam tape at all joints.

4. Penetration Filler:

- a. Provide insulation sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.

5. Gap Air Infiltration Filler:

- a. Provide two component, quick cure polyurethane foam.

6. Joint Closure System:

- a. PVC interlocking male/female "T" mold and "J" mold profiles for application of insulation boards to wall/ceiling. System shall support insulation boards and provide finish trim for all edges of boards.

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. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.
- F. Install insulation with air barrier in a way that provides continuity throughout the building envelope. Install materials in accordance with manufacturer's instructions.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Spray-applied Insulation: Apply according to requirements of Section 072119 – Foamed-in-Place Insulation, and manufacturer's written instructions.

3.4 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

SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Closed-cell spray polyurethane foam.
- B. Related Requirements:
 - 1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

- A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 2.0 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Corporation.
 - b. Dow Chemical Company (The).
 - c. Henry Company.
 - d. Johns Manville; a Berkshire Hathaway company.
 - e. SWD Urethane Company.
 - f. Volatile Free, Inc.
2. Surface-Burning Characteristics: Comply with ASTM E 84; 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.
3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

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. Vapor-permeable, fluid-applied air barriers.

- B. Related Requirements:

- 1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

- B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate 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.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
 - b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier. Air-barrier assemblies shall 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.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils over smooth, void-free substrates.
 - 1. Products: 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. Carlisle Coatings & Waterproofing Inc; Barrithane VP.
 - b. Hohmann & Barnard, Inc; Enviro-Barrier VP.
 - c. Sto Corp.; Sto AirSeal®.
 - d. W.R. Meadows, Inc; Air-Shield LMP.
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum 10 perms; ASTM E 96/E 96M, Desiccant Method, Procedure A.
 - c. Ultimate Elongation: Minimum 250 percent; ASTM D 412, Die C.
 - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D 4541.

- e. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

- A. Requirement: 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 air-barrier 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.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.
 - b. Pecora Corporation;
 - c. The Dow Chemical Company.
 - d. Tremco Incorporated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints, expansion joints discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
 - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously 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.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. 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.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone extrusion 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.

1. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
 1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.
- C. Do not cover air barrier until it has been tested and inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, 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. Air-barrier dry film thickness.
3. Continuous structural support of air-barrier system has been provided.
4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
5. Site conditions for application temperature and dryness of substrates have been maintained.
6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. 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.
9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

C. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074213.23 - METAL COMPOSITE MATERIAL WALL AND SOFFIT PANELS

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 metal composite material wall and soffit panels.
 - 1. Metal composite material (MCM) panels.
 - 2. Metal composite material (MCM) systems.
- B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" for metal framing supporting MCM panels.
 - 2. Section 072100 "Thermal Insulation" for foam-plastic board insulation sheathing installed behind MCM panels.
 - 3. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing installed in conjunction with MCM panels.

1.3 DEFINITIONS

- A. MCM: Metal composite material; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
 - 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. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.

6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
8. Review procedures for repair of panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel, system, and accessory.
 1. Metal composite material (MCM) panels.
 2. Metal composite material (MCM) system.
- B. Shop Drawings:
 1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
 3. Provide signed and sealed drawings, by a qualified design professional in Project jurisdiction, of MCM system showing compliance with performance requirements and design criteria identified for this Project.
- C. Samples for Verification: For each type of MCM panel MCM system required, with factory-applied color finishes.
 1. MCM Panel: One sample, 4 by 6 inches.
 2. MCM System: 12 inches long by actual panel width, fabricated into panel systems indicated. Include fasteners, closures, and other MCM panel accessories. Panel sample need not be provided in the specified color.
- D. Delegated Design Submittals:
 1. For MCM system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Test and Evaluation Reports:
 1. Product Test Reports: For each MCM panel and MCM system, for tests performed by manufacturer and witnessed by a qualified testing agency.
 - a. MCM Panel Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.

- b. Fabricator's MCM System Test Reports: Certified test reports showing system compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.
 - 1) Dry Seal System: Tested to AAMA 501.1.
 - 2. Research Reports: For MCM systems, from an agency acceptable to authorities having jurisdiction.
 - 3. Preconstruction Test Reports: For MCM system.
 - B. Qualification Statements: For manufacturer, fabricator and installer.
 - C. Delegated design engineer qualifications.
 - D. Sample warranties.
- 1.7 CLOSEOUT SUBMITTALS
 - A. Maintenance Data: For MCM panels.
 - B. Warranty Documentation:
 - 1. Manufacturers' special warranties.
 - 2. Installer's special warranties.
- 1.8 QUALITY ASSURANCE
 - A. Qualifications:
 - 1. Manufacturer: Minimum 5 years' experience.
 - 2. Fabricator: Approved by MCM panel manufacturer.
 - 3. Installer: Fabricator of MCM system Entity that employs installers and supervisors who are trained and approved by MCM system manufacturer.
 - 4. Delegated Design Engineer: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
- 1.9 MOCKUPS
 - A. Build mockups to verify selections made under Sample submittals to demonstrate aesthetic effects, to set quality standards for fabrication and installation and for preconstruction testing.
 - 1. Build mockup approximately 5 by 5 feet, including corner, soffits, supports, attachments, and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
- B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal composite material panels during installation.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.12 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.13 WARRANTY

- A. Panel Integrity Warranty: Manufacturer agrees to repair or replace components of MCM panels that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Panel Finish Warranty: Manufacturer agrees to repair finish or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

- C. MCM System Warranty: Fabricator's standard form in which manufacturer agrees to repair or replace components of MCM systems 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 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design MCM system, including support structure.
- B. Seismic Performance: No failure or deterioration of the system when laterally racked to 3/4 inch (in both directions and repeated for three cycles in accordance with AAMA 501.4. System must pass the static water test as described in ASTM E331 following the seismic racking.
- C. Structural Performance: MCM systems to withstand the effects of the following loads, based on testing in accordance with ASTM E330/E330M:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- D. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E283/E283M at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- E. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL COMPOSITE MATERIAL (MCM) WALL AND SOFFIT PANELS

- A. Metal Composite Material Wall and Soffit Panel Systems: Provide factory-formed and -assembled, metal composite material wall and soffit panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ALPOLIC Materials; Mitsubishi Chemical Composites; ALPOLIC/PE, or comparable product by, but not limited to, one of the following:
 - a. ALUCOBOND; 3A Composites USA, Inc.
 - b. Alucoil North America.

- c. Arconic.
 - 1. Core: Standard.
 - 2. Panel Thickness: 0.157 inch.
 - 3. Bond Strength: 22.5 in-lb/in. when tested for bond integrity in accordance with ASTM D1781.
 - 4. Fire Performance: Flame-spread index less than 25 and smoke-developed index less than 450, in accordance with ASTM E84 or UL 723.
- B. Metal Composite Material Panel Materials:
 - 1. Aluminum-Faced Composite Wall and Soffit Panels: ASTM B209 alloy as standard with manufacturer, temper as required to suit finish and forming operations with 0.020-inch-thick, aluminum sheet facings.
 - a. Exterior Finish: Fluoropolymer; type as applicable to the color.
 - b. Color: As indicated on Drawings.

2.3 METAL COMPOSITE MATERIAL (MCM) SYSTEM

- A. Dry-Seal Barrier MCM System: Provide factory-formed and assembled, MCM panels formed into profile for dry-seal barrier system installation. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
- B. System Panel Depth: 1 1/2 inch.
- C. Attachment Assembly Components: Manufacturer's standard formed from extruded aluminum.
- D. Labeling: Comply with labeling requirement of applicable building code.

2.4 ACCESSORIES

- A. Metal Subframing and Furring: ASTM C 955, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.
- B. System Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Use gasketed or approved coated fasteners between dissimilar metals.

1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
2. Provide exposed fasteners with heads matching color of MCM panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

2.5 FABRICATION

- A. Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing.
- B. Shop-fabricate MCM systems and accessories by fabricator's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with requirements of MCM panel manufacturer, of indicated system profiles, and with dimensional and structural requirements.
 1. Fabricate panels to dimensions indicated on Drawings based on an assumed design temperature of 70 deg F. Allow for ambient temperature range at time of fabrication.
 2. Formed MCM panel lines, breaks, and angles to be sharp and straight, with surfaces free from warp or buckle.
 3. Fabricate panels with sharply cut edges and no displacement of face sheet or protrusion of core.
 4. Fabricated Panel Tolerances: Shop-fabricate panels to sizes and joint configurations indicated on Drawings.
 - a. Width: Plus or minus 0.079 inch at 70 deg F.
 - b. Length: Plus or minus 0.079 inch at 70 deg F.
 - c. Squareness: Plus or minus 0.079 inch at 70 deg F.
 5. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
 6. Attach routed-and-retained panel flanges to panel clips with manufacturer's standard fasteners.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

- a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall and soffit panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:
 1. PVDF Fluoropolymer: AAMA 2605, two-coat fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color: MBU Blue.
 2. FEVE Fluoropolymer: AAMA 2605, two-coat with shimmer effect, fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color: NWS White Silver.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall and soffit panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall and soffit panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF MCM SYSTEM

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal composite material panels.
 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal composite material panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
 9. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
 10. Attach MCM panels to supports at locations, spacings, and with fasteners recommended by manufacturer to meet listed performance requirements.
- B. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall and soffit panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Install subframing, furring, and other panel support members and anchorages in accordance with ASTM C955.
 2. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- C. Dry-Seal MCM System: Attach MCM panels by interlocking panel clips into channels.
1. Seal horizontal and vertical joints between adjacent MCM panels with manufacturer's standard gaskets.
- D. Subgirt-and-Spline Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard subgirts and splines that provide support and complete secondary drainage assembly, draining to the exterior at horizontal joints. Attach metal composite material wall and soffit panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
- E. Install panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
- F. Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install accessory components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer.
 2. Do not apply sealants to joints unless otherwise indicated.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.3 INSTALLATION TOLERANCES

- A. Shim and align metal composite material wall and soffit panel unites within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration in accordance with AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed MCM system installation, including accessories.
- D. MCM system will be considered defective if it does not pass test and inspections.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.
- B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

3.6 PROTECTION

- A. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.23

SECTION 074243 – PHENOLIC WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Exterior high pressure laminate composite panels at walls and soffits.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings.
 - 1. Show fabrication and installation layouts including direction of wood grain finish on panels, details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, accessories; and special details.
- C. Samples:
 - 1. Panels: Submit three 8.5 by 11 inches for each finish.
 - 2. Accessories: 8 inch long section.
 - 3. Assembly Samples: Assemble panel, 24 by 36 inches, showing subframe and fasteners.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates:
 - 1. Manufacturer Certificate: Intertek Code Compliance Research Report (CCRR) indicating compliance with IBC.
- B. Installation instructions: Submit manufacturer instructions including surface preparation and installation procedures.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panels.
- B. Warranty Documentation: For panels.

1.6 QUALITY ASSURANCE

- A. Mockups: Construct 48 by 48 inch minimum mockup, demonstrating product interfaces, intersections, and terminations.

1. Approved mockups establish work results standard.
2. Approved mockups may remain as a part of the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Refer to manufacturer user manual.
1. Transport panels strapped down horizontally to avoid sliding; protect edges and corners.
- B. Storage: Refer to manufacturer user manual.
1. Maintain in original protective package until use.
 2. Store in a clean, dry, enclosed, and ventilated area.
 - a. Temperature: 50 degrees F, minimum, 80 degrees F, maximum.
 - b. Humidity: 30 percent, minimum, 70 percent, maximum.
 3. Store horizontally on elevated platforms, with supports 24 inches apart, maximum.
 4. Cover panels to match original packaged condition while not in use.
- C. Handling: Lift and move panels evenly to avoid scratching the decorative surface.

1.8 FIELD CONDITIONS

- A. Existing Conditions: Verify field measurements before fabrication. Show field measurements on Shop Drawings.
- B. Bearing wall must be plumb, with a maximum deviation of 1/8 inch over 40 inches.

1.9 WARRANTY

- A. Manufacturer Warranty:
1. Warrant against product failure.
 - a. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WALL PANELS

- A. High Pressure Laminate Wood Veneer Wall and Soffit Panels: High density panels with natural wood veneers, thermoset phenolic resin core, and UV resistant coating.
1. Basis of Design: Provide Parklex Prodema; NATURCLAD-W S or comparable product approved prior to bidding.
 2. Thickness: 10 mm.
 3. Size: As indicated in Drawings.
 4. Wood Veneer: As required by the manufacturer for the colors indicated.
 5. Color: As indicated in drawings.
 6. Joint Width: 3/8 inch.
 7. Installation Method: Concealed fastening with hanging hook.
 8. Physical Properties:
 - a. Modulus of Elasticity: 1,500,000 psi minimum, ASTM D1037.
 - b. Flexural Strength: 9,000 psi minimum crossgrain, 15,000 psi minimum longgrain, ASTM D1037.

- c. Freeze-Thaw Resistance: No change, ICC-ES AC92 Section 3.2.2
- d. Water Resistance: No change, ASTM D2247.
- e. Resistance to Weathering: No change after 2,000 hours, minimum, ASTM G155.
- f. Salt Spray Resistance: No change after 300 hours, minimum, ASTM B117.

2.2 ACCESSORIES

- A. Manufacturer standard components as required for complete installation:
- B. Concealed Fastening with Hanging Hooks: Aluminum J channels, hanging rails, hanging hooks, clamping screws, levelling screws, fixing screws.

2.3 PERFORMANCE

- A. Delegate support framing design to installer's structural engineer, licensed in the State of Utah.
- B. Structural Design Criteria and Loads: See Structural Drawings.
- C. Surface Burning Performance: ASTM E84 Class A.
 - 1. Flame Spread Index: 25, maximum.
 - 2. Smoke Developed Index: 450, maximum.
- D. Environmental Performance:
 - 1. Expansion and Contraction: Withstand 120 degree F ambient and 180 degree F surface thermal cycling without failure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates 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 PREPARATION

- A. Condition product per manufacturer recommendations.

3.3 INSTALLATION, GENERAL

- A. Follow manufacturer instructions.
- B. Anchor panels and sub-framing securely per engineering recommendations and approved Shop Drawings to allow for necessary movement and structural support.
- C. Cut and drill panels, confirming fixed and floating points, and locate fastener hole spacing according to manufacturer recommendations.

- D. Install plumb, level, and accurately spaced according to manufacturer recommendations and approved submittals and Shop Drawings.
- E. Fasten panels with fasteners approved for use with supporting substrate.
- F. Maintain 3/4 inch minimum air space behind panels.
- G. Maintain base and head ventilation spaces of 3/4 inch, minimum.
- H. Fastener and hanging hooks to edge distance within manufacturer recommendation.
- I. Replace damaged panels.

3.4 INSTALLATION, CONCEALED FASTENING SYSTEM

- A. Install hanging rails over uninterrupted vertical subframe components 3/4 inch deep minimum, spaced per manufacturer recommendations.
- B. Install hooks on back of panels per manufacturer instructions.
- C. Hang hooks on rails, adjust height for consistent joint spacing and lock panel in place horizontally with screw through top center hook.
- D. Maintain gap between panels of 1/4 inch, minimum.
- E. Maintain distance from hanging hook to panel edge per manufacturer recommendations.

3.5 CLEANING

- A. Follow manufacturer cleaning instructions.
- B. Remove protection film immediately after installation.
- C. Clean finished surfaces as recommended by panel manufacturer; do not use abrasive cleaners.

END OF SECTION 074243

SECTION 075419 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. New PVC roofing system.
2. Patching and repair of existing, mechanically fastened, polyvinyl chloride (PVC) roofing system.
3. Roof Insulation
4. Vapor retarder.
5. Cover board.
6. Walkways.

- B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.
- B. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.
- C. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck

- Installer, air barrier installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 7. Review governing regulations and requirements for insurance and certificates if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.
- A. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
 1. Layout and thickness of insulation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. Tapered insulation thickness and slopes.
 5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
 6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 7. Tie-in with air barrier.
- B. Samples for Verification: For the following products:
 1. Roof membrane and flashing, of color required.
 2. Walkways
- C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- C. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
 - D. Product Test Reports: For roof membrane and insulation, tests performed by independent qualified testing agency indicating compliance with specified requirements.
 - E. Evaluation Reports: For components of roofing system, from ICC-ES.
 - F. Sample Warranties: For manufacturer's special warranties.
- 1.7 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For roofing system to include in maintenance manuals.
 - B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.
- 1.8 QUALITY ASSURANCE
- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.
 - B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty prior to receipt of bids.
 1. A minimum of ten years experience is required on similar sized projects.
 - C. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
 2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, and other components of roofing system.
 - 2. Warranty Period: 30 years from date of Substantial Completion.
 - 3. Refer to section 012300 "Alternates" for alternate membrane thicknesses and warranty periods.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, vapor retarders, and walkway products, for the following warranty period:
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to

defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.

1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
1. Zone 1 (Roof Area Field): As indicated in General Structural Notes.
 2. Zone 2 (Roof Area Perimeter): As indicated in General Structural Notes.
 3. Zone 3 (Roof Area Corners): As indicated in General Structural Notes.
- D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
1. Fire/Windstorm Classification: Class 1A-105.
- E. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 POLYVINYL CHLORIDE (PVC) ROOFING SYSTEM

- A. PVC Sheet: ASTM D4434/D4434M, Type III, fabric reinforced.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated; Carlisle Construction Materials.
 - b. Sika Sarnafil.
 2. Thickness: 80 mils minimum, with 38 mils, minimum, above the scrim.
 3. Exposed Face Color: White.
- B. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.3 ACCESSORY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.

- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Bonding Adhesive: Manufacturer's standard, water based.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- F. Precoated PVC Clad Metal: Metal shall be 0.023 inch thick, G90 galvanized sheet metal laminated with 0.020 inch thick PVC membrane.
- G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
- I. Wood Nailers: Install treated wood nailers at the perimeter of the entire roof and around such other roof projections and penetrations as indicated. Thickness of nailers must match the insulation thickness in order for a smooth transition.
 - 1. Wood nailers shall be treated for fire and rot resistance (wolmanized or osmose treated), #2 quality or better lumber. Creosote or asphaltic-treated lumber is not acceptable.
 - 2. Wood nailers shall conform to Factory Mutual's Loss Prevention Data 1-49.
 - 3. All wood shall have a moisture content no higher than 19 percent by weight on a dry weight basis.

2.4 VAPOR RETARDER

- A. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil (1.0-mm) total thickness; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by PVC roof membrane manufacturer, approved for use in SPRI's Directory of Roof Assemblies listed roof assemblies.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 2, Grade 3, felt or glass-fiber mat facer on both major surfaces.
 - 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. Atlas Roofing Corporation - Polyiso.
 - b. Carlisle SynTec Incorporated.

- c. Sika Sarnafil.
 2. Compressive Strength: 25 psi.
 3. Size: 48 by 96 inches.
 4. Thickness: Two layers of equal thickness to provide R-value indicated on Drawings.
 - a. Base Layer: 2-1/2 inches.
 - b. Upper Layer: As required to provide overall R-value indicated on Drawings.
- C. Tapered Insulation: Provide factory-tapered insulation boards.
 1. Material: Molded (Expanded) Polystyrene Board Insulation: ASTM C 578, Type II, 1.35 lb/cu.ft. minimum density, 15-psi minimum compressive strength, square edge.
 2. Minimum Thickness: 1/4 inch.
 3. Slope:
 - a. Roof Field: 3/8 inch per foot unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/4 inch per foot in valleys unless otherwise indicated on Drawings

2.6 INSULATION ACCESSORIES AND COVER BOARD

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 1. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
- D. Cover Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Gypsum LLC; DensDeck Prime Roof Board.
 - b. USG Corporation; Securock Glass Mat Roof Board.
 2. Thickness: 1/2 inch.
 3. Surface Finish: Factory Primed.

2.7 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.
 1. Size: Approximately 30 inches.
 2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 NAILERS

- A. Continuous treated wood nailers shall be installed at the perimeter of the entire roof and around roof projections and penetrations as indicated and as shown on project drawings.
- B. Nailers shall be anchored to resist a minimum force of 300 pounds per lineal foot in any direction. A 1/2-inch space shall be provided between nailer lengths. Individual nailer lengths shall not be less than 3 feet long. Nailer fastener spacing shall be at 12 inches on center. Fasteners shall be staggered 1/3 the nailer width, and installed within 6 inches of each end. Nailer attachment shall meet this requirement and that of the current Factory Mutual Loss Prevention Data Sheet 1-49.
- C. Thickness shall be as required to match substrate or insulation height to allow a smooth transition.

3.4 ROOF DRAINS

- A. Construct sloped drain sumps out of factory pre-tapered polyisocyanurate Q panels. Install cover board over pre-tapered panels followed by membrane. Positive drainage is to be obtained in entire sump area. There shall be no standing water in the drain sump areas. See plans for tapered drain detail.

3.5 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 072726 "Fluid-Applied Membrane Air Barriers."

3.6 INSTALLATION OF VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches, respectively.
 - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 - 2. Seal laps by rolling.
 - 3. Locate side lap seams on top of deck flutes for continuous support.
 - 4. Locate end lap seams on top of metal utility plate for continuous support.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.7 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Metal Decking:
 - 1. Install base layer of insulation with end joints staggered not less than 12 inches in adjacent rows and with long joints continuous at right angle to flutes of decking.
 - a. Locate end joints over crests of decking.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding 1/4 inch with insulation.
 - f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

- g. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - 1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
 - 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
- 2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - f. Trim insulation so that water flow is unrestricted.
 - g. Fill gaps exceeding 1/4 inch with insulation.
 - h. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - i. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
 - 1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing, and maintaining insulation in place.

3.8 INSTALLATION OF COVER BOARD

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
- C. Install cover boards over inside face of cold-formed metal framing at framed parapet walls. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 - 3. Install panels with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- D. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- E. Horizontal Installation: Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. 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.

3.9 MECHANICALLY FASTENED ROOFING INSTALLATION

- A. Mechanically fasten roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. For in-splice attachment, install roof membrane with long dimension perpendicular to steel roof deck flutes.
- D. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- E. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- F. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.
- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- H. In-Seam Attachment: Secure one edge of PVC sheet using fastening plates or metal battens centered within seam, and mechanically fasten PVC sheet to roof deck.
- I. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- J. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.10 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.11 INSTALLATION OF WALKWAYS

- A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.
 - 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.
 - 2. Provide 6-inch clearance between adjoining pads.
 - 3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.12 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.13 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.14 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: Jordan School District.
 2. Address: 7387 S. Campus View Drive, West Jordan, UT 84084.
 3. Building Name/Type: Valley High School.
 4. Address: (Approximately) 325 11000 S, South Jordan, UT 84095.
 5. Area of Work: Partial Roof on Building, as indicated on Drawings.
 6. Acceptance Date: _____.
 7. Warranty Period: Five years.
 8. Expiration Date: _____.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 90 mph ;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

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

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075419

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Formed low-slope roof sheet metal fabrications.
 - 2. Formed wall sheet metal fabrications.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 042000 "Unit Masonry" for materials and installation of manufactured sheet metal through-wall flashing and trim integral with masonry.
 - 3. Section 074213.23 "Metal Composite Material Wall and Soffit Panels" for sheet metal flashing and trim integral with metal wall and soffit panels.
 - 4. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each of the following
 - 1. Underlayment materials.
 - 2. Elastomeric sealant.
 - 3. Butyl sealant.
 - 4. Epoxy seam sealer.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
 - 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
 - 4. Include details for forming, including profiles, shapes, seams, and dimensions.
 - 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 6. Include details of termination points and assemblies.
 - 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 - 8. Include details of roof-penetration flashing.
 - 9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
 - 10. Include details of special conditions.
 - 11. Include details of connections to adjoining work.
 - 12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.
- C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For copings and roof edge flashing, from ICC-ES or other agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.
- E. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
- B. Special warranty.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge, including, approximately 10 feet long, including supporting construction cleats, seams, attachments, and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
 - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 - 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. FM Approvals Listing: Manufacture and install copings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish:
 - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1) Run grain of directional finishes with long dimension of each piece.
 - 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

- C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A755/A755M.
 - 1. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides.
 - 2. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. 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.
 - 3. Color: As selected by Architect from manufacturer's full range Insert color.
 - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 - 2. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
 - 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.
- C. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polysulfide polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- D. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- E. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

- F. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corporation.
 - b. Heckmann Building Products, Inc.
 - c. Hohmann & Barnard, Inc.
 - d. Keystone Flashing Company, Inc.
 2. Source Limitations: Obtain reglets from single source from single manufacturer.
 3. Material: Galvanized steel, 0.022 inch thick.
 4. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 5. Accessories:
 - a. 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 Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
 6. Finish: With manufacturer's standard color coating.

2.4 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Seams:
1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
 - a. Fabricate copings with standing seams.
- H. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters:
1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
 2. Fabricate in minimum 96-inch- long sections.
 3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
 4. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
 5. Gutter Profile: Style F in accordance with cited sheet metal standard.
 6. Expansion Joints: Lap type.
 7. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen.
 8. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.
 9. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following materials:
 - a. Galvanized Steel: 0.028 inch thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

10. Gutters with Girth 21 to 25 Inches (530 to 640 mm): Fabricate from the following materials:
 - a. Galvanized Steel: 0.034 inch thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: 0.034 inch thick.
 11. Gutters with Girth 26 to 30 Inches (660 to 760 mm): Fabricate from the following materials:
 - a. Galvanized Steel: 0.040 inch thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.
- B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
1. Fabricated Hanger Style: Fig. 1-35A in accordance with SMACNA's "Architectural Sheet Metal Manual."
 2. Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, watertight.
1. Coping Profile: Match existing profile, and comply with SMACNA's "Architectural Sheet Metal Manual" requirements for that profile.
 2. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate.
 3. Fabricate from the following materials:
 - a. Galvanized Steel: 0.040 inch thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.
- C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.
- D. Flashing Receivers: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot- long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
 6. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 7. Do not field cut sheet metal flashing and trim by torch.
 8. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters:
1. Join sections with joints sealed with sealant.
 2. Provide for thermal expansion.
 3. Attach gutters at eave or fascia to firmly anchor them in position.
 4. Provide end closures and seal watertight with sealant.
 5. Slope to downspouts.
 6. Fasten gutter spacers to front and back of gutter.
 7. Anchor and loosely lock back edge of gutter to continuous cleat.
 8. Anchor gutter with straps spaced not more than 30 inches apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.

9. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 ft. apart. Install expansion-joint caps.
10. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.

3.4 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
 1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Copings:
 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
 - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
 3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
 1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 2. Extend counterflashing 4 inches over base flashing.
 3. Lap counterflashing joints minimum of 4 inches.
 4. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

3.5 INSTALLATION OF WALL FLASHINGS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.6 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

3.8 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Roof hatches.

- B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
- 2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: For roof accessories.

- 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
 - 5. Electrical connections.
- B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF HATCHES

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
 - 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. Activar Construction Products Group, Inc. - JL Industries.
 - b. Babcock-Davis.
 - c. BILCO Company (The).
 - d. Milcor; a division of Hart & Cooley, Inc.
- B. Type and Size: Single-leaf lid, 36 by 84 inches.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
1. Dome Glazing: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet at curbs.
1. Thickness: Manufacturer's standard thickness for hatch size indicated.
 2. Finish: Two-coat fluoropolymer.
 3. Color: As selected by Architect from manufacturer's full range.
- E. Hatch Material: Aluminum sheet at covers.
1. Thickness: Manufacturer's standard thickness for hatch size indicated.
 2. Finish: Two-coat fluoropolymer.
 3. Color: As selected by Architect from manufacturer's full range.
- F. Construction:
1. Insulation: 1-inch- thick, glass-fiber board.
 - a. R-Value: 4.3 according to ASTM C1363.
 2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 3. Hatch Lid: Glazed, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 6. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
 7. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.
- G. Hatch-Lid Glazing: Double polycarbonate glazing of thickness capable of resisting indicated loads.
1. Outer Double-Dome Color: White, translucent.
 2. Inner Double-Dome Color: White, translucent.
- H. Hardware: Spring operators, hold-open arm, galvanized steel spring latch with turn handles, galvanized steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
1. Provide two-point latch on lids 84 inches, or larger.
- I. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: 42 inches above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard.
 - a. Color: As selected by Architect from manufacturer's full range.

2.3 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.
 1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, AZ50 coated.
 1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- C. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 1. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

- D. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
- E. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.
- F. Steel Tube: ASTM A500/A500M, round tube.
- G. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.
- H. Steel Pipe: ASTM A53/A53M, galvanized.

2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Glass-Fiber Board Insulation: ASTM C726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWWA C2; not less than 1-1/2 inches thick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Underlayment:
 - 1. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.
 - 2. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
- F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- H. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof-Hatch Installation:
 - 1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

2. Attach safety railing system to roof-hatch curb.
 3. Attach ladder-assist post according to manufacturer's written instructions.
- D. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

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. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

- B. Related Requirements:

1. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
2. Section 092900 "Gypsum Board" for sealing joints in sound-rated construction.
3. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.

- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Preconstruction Laboratory Test Reports: 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.
- D. 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.
- E. Field-Adhesion-Test Reports: For each sealant application tested.
- F. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 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 Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
 - 1. Architectural sealants shall have a VOC content of 250 g/L or less.
 - 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 - 3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.; Silpruf SCS2700.
 - c. Pecora Corporation; 890.

- d. Tremco Incorporated; Spectrem 1.

2.3 URETHANE JOINT SEALANTS

- A. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Bostik, Inc.; Chem-Calk 555-SL.
- b. Pecora Corporation; Dynatrol II SG Urexpam NR 200
- c. Sherwin-Williams Company (The); Stampede-2SL.
- d. Tremco Incorporated; THC 900/901.

2.4 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 C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Dow Corning Corporation; 786-M White.
- b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
- c. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 100 WF.
- d. Tremco Incorporated; Tremsil 200.

2.5 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Bostik, Inc.; Chem-Calk 300.
- b. Pecora Corporation; BC-158.

2.6 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Construction Chemicals - Building Systems; Sonolac.
 - b. Pecora Corporation; AC-20.
 - c. Tremco Incorporated; Tremflex 834.

2.7 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 1. 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:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. BASF Construction Chemicals - Building Systems.
 - b. Construction Foam Products, a division of Nomaco, Inc.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 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.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

- a. 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.
3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. 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.
 4. 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.
 5. 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.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
- 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.
- 3.7 JOINT-SEALANT SCHEDULE
- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.

2. Joint Sealant: Urethane, M, P, 25, T, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Perimeter joints between materials listed above and frames of doors, windows and louvers.
 - d. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, nonstaining, S, NS, 100/50, T, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Building standard unless noted otherwise.
 2. Joint Sealant: Silicone, nonstaining, S, NS, 100/50, T, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Concealed mastics.
1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Butyl-rubber based.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes acoustical joint sealants.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.3 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

1. Sealant shall have a VOC content of 250 g/L or less.

2.2 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. GE Construction Sealants; RCS20 Acoustical.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Tremco, Incorporated; Tremco Acoustical Sealant.
 - d. USG Corporation; SHEETROCK Acoustical Sealant.
 2. Colors of Exposed Acoustical Joint Sealants: As indicated by manufacturer's designations Match Architect's samples as selected by Architect from manufacturer's full range of colors Insert color.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- 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 acoustical 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 acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

- B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. 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 ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect acoustical 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 acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079219

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. Interior standard steel doors and frames.
 - 2. Exterior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:

1. Elevations of each door type.
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 each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
2. Fabrication: Prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.
- B. Field quality control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. Pioneer Industries.
 - 4. Republic Doors and Frames.
 - 5. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
 - d. Edge Construction: Model 1, Full Flush or Model 2, Seamless.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.
 - 2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.

- b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
- c. Construction: Full profile welded.
- 3. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum-Duty Doors and Frames: ANSI/SDI A250.8, Level 4; ANSI/SDI A250.4, Level A.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A60 coating.
 - d. Edge Construction: Model 1, Full Flush or Model 2, Seamless.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Manufacturer's standard.
 - 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A60 coating.
 - b. Construction: Full profile welded.
 - 3. Exposed Finish: Prime.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
 - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.7 FABRICATION

- A. Door Astragals: Provide overlapping astragal 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 or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Sidelite Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Plaster Guards: Provide minimum 0.0179 inch thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
- D. Supplemental Hinge Reinforcement: Provide 0.14 inch thick bent plate welded to frame in three locations, located above and below standard hinge reinforcement as required by SDI standards.

- E. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- F. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

- a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
- b. Install frames with removable stops located on secure side of opening.
2. Fire-Rated Openings: Install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
4. Solidly pack mineral-fiber insulation inside frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
8. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - a. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8 .
 - b. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
9. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

- B. Related Requirements:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Door frame construction.
6. Factory-machining criteria.
7. Factory-finishing specifications.

- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.

- C. Samples for Verification:

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 finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Special warranties.
- B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.
- B. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, 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 remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Doors:

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. Eggers Industries.
 - b. Oshkosh Door Company.
 - c. VT Industries Inc.
2. Performance Grade:
 - a. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated on Drawings.
3. ANSI/WDMA I.S. 1A Grade: Premium.
4. Faces: Single-plywood veneer not less than 1/50 inch thick.
 - a. Species: Red oak.
 - b. Cut: Plain sliced (flat sliced).
 - c. Match between Veneer Leaves: Book match.
 - d. Assembly of Veneer Leaves on Door Faces: Balance match.
 - e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
5. Exposed Vertical and Top Edges: Same species as faces - Architectural Woodwork Standards edge Type A.
 - a. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

- 1) Screw-Holding Capability: 550 lbf or 475 lbf as applicable to the performance duty and in accordance with WDMA T.M. 10.
6. Core for Non-Fire-Rated Doors:
- a. ANSI A208.1, Grade LD-2 particleboard.
 - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware. follows:
 - a) 5-inch top-rail blocking, in doors indicated to have closers. Closers are through-bolted as a District Standard.
 - b) 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - 2) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087100 "Door Hardware."
7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
1. Wood Species: Same species as door faces.
 2. Profile: Flush rectangular beads.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied.
1. Locate hardware to comply with DHI-WDHS-3.
 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.6 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 2. Finish faces, all four edges, edges of cutouts, and mortises.
 3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 1. Finish: Architectural Woodwork Standards System-10, UV Curable, Water Based.
 2. Staining: Match Architect's sample.
 3. Effect: Filled finish.
 4. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- 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.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.

- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS 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 access doors and frames for walls and ceilings.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for access door allowance.

1.3 ALLOWANCES

- A. Access doors and frames are part of an access door and frame allowance.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.
- C. Product Schedule: For access doors and frames.

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. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Karp Associates, Inc.

- e. Larsens Manufacturing Company.
 - f. Milcor; Commercial Products Group of Hart & Cooley, Inc.
- 2. Description: Face of door flush with frame, with exposed flange and continuous, concealed hinge.
 - 3. Locations: Wall and ceiling.
 - 4. Door Size: 24 by 24 inches, unless indicated otherwise.
 - 5. Uncoated Steel Sheet for Door: Nominal 0.075 inch (1.90 mm), 14 gage, factory finished.
 - 6. Metallic-Coated Steel Sheet for Door: Nominal 0.07 inch, factory finished.
- a. Use metallic-coated steel at toilet rooms.
- 7. Frame Material: Same material and finish as door, nominal 0.060 inch (1.52 mm), 16 gage thick.
 - 8. Latch and Lock: Furnish one key-operated cylinder lock per door and flush, screwdriver-operated cam locks in number required to hold door in flush smooth plane when closed; if only one locking device is required to hold door as indicated above, provide only the key operated cylinder lock.

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. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Frame Anchors: Same material as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

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.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

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 Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.
 - a. Color: As selected by Architect from full range of industry colors.

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 FIELD QUALITY CONTROL

- A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Insulated service doors.

- B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports and door-opening framing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.

- 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
- 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

- 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.
- 4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
- 5. Show locations of controls, locking devices, and other accessories.
- 6. Include diagrams for power, signal, and control wiring.

- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

- 1. Include similar Samples of accessories involving color selection.

- D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.
2. Bottom bar with sensor edge.
3. Guides.
4. Brackets.
5. Hood.
6. Locking device(s).
7. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Special warranty.
- B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors 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 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
- B. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:

1. Design Wind Load: As indicated on Drawings, but not less than a uniform pressure of 20 lbf/sq. ft., acting inward and outward.
 2. Testing: According to ASTM E330/E330M.
 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
- C. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Component Importance Factor: 1.0.
- 2.3 DOOR ASSEMBLY – EXTERIOR DOORS
- A. Insulated Service Door: Overhead coiling 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, but are not limited to the following:
 - a. Alpine Overhead Doors, Inc.
 - b. Cookson; a CornellCookson company.
 - c. Cornell; a CornellCookson company.
 - d. McKeon Door Company.
 - e. Overhead Door Corporation.
 - f. Raynor Garage Doors.
 - g. Wayne Dalton; a division of Overhead Door Corporation.
- B. Operation Cycles: Door components and operators capable of operating for not less than 100,000. 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.
1. Include tamperproof cycle counter.
- C. Air Infiltration: Maximum rate of 1.0 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283.
- D. Insulated Door Assembly U-Factor: 0.31 Btu/deg F x h x sq. ft.
- E. Door Curtain Material: Galvanized steel.
- F. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.
1. Insulated-Slat Interior Facing: Metal.
 2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from hot-dip galvanized steel and finished to match door.
- H. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- I. Hood: Match curtain material and finish.
1. Shape: Square unless indicated otherwise on Drawings.

2. Mounting: Face of wall unless indicated otherwise on Drawings.

J. Locking Devices: Equip door with slide bolt for padlock.

K. Electric Door Operator:

1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
2. Operator Location: Bench.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Motor Exposure: Interior.
5. Motor Electrical Characteristics:
 - a. Horsepower: As required by manufacturer.
 - b. Voltage: 115-V ac, single phase, 60 Hz.
6. Emergency Manual Operation: Crank type.
7. Obstruction-Detection Device: Automatic photoelectric sensor; self-monitoring type.
8. Control Station(s): Interior mounted.

L. Curtain Accessories: Equip door with weatherseals.

M. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Finish as selected by Architect from manufacturer's full range.

2.4 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, 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.
2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch and minimum aluminum thickness of 0.032 inch.

- 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, and a continuous bar for holding windlocks.

2.6 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.

2.7 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

2.9 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. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.
 - 1. Bench Mounted: Operator is mounted to the right or left door head plate and connected to the door drive shaft with drive chain and sprockets. Side room is required for this type of mounting.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.
 - 1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 - 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
 - 1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

- a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 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.

2.12 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

- A. Install overhead coiling 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 overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.
- D. Power-Operated Doors: Install according to UL 325.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.
- B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 083513.13 - MULTIPANEL FOLDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Multipanel folding aluminum-framed glass doors.

B. Related Requirements:

1. Section 087100 "Door Hardware" hardware not specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Multipanel folding aluminum-framed glass doors.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for multipanel folding aluminum-framed glass doors.

C. Shop Drawings:

1. Include plans, elevations, sections, and installation details.
2. Indicate dimensions, configuration of panels, and stacking layout.

D. Samples for Initial Selection: For doors and hardware with factory-applied color finish.

E. Samples for Verification: For multipanel folding aluminum-framed glass doors and components required, prepared on Samples of size indicated below:

1. Assembly Sample: 24 by 36 inches with frame, glazing, weather stripping, glazing bead and factory-applied color finish.
2. Hardware: Full-size units with factory-applied finish.
3. Glass: Two, 12 by 12 inch square samples.

F. Product Schedule: For multipanel folding aluminum-framed glass doors.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer and manufacturer.

B. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data:

1. For multipanel folding aluminum-framed glass doors to include in maintenance manuals. Include finishes, weather stripping, operable panels, and operating hardware.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating multipanel folding aluminum-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Installer Qualifications: An installer acceptable to multipanel folding aluminum-framed glass door manufacturer for installation of units required for this Project.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup for multipanel folding aluminum-framed glass doors, as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace multipanel folding aluminum-framed glass doors that fail(s) 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 excess deflection.
- c. Faulty operation of movable panels and hardware.
- d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- e. Failure of laminated glass.

2. Warranty Period:

- a. Multipanel Folding Aluminum-Framed Glass Doors: 10 year(s) from date of Substantial Completion.
- b. Laminated Glass: Five years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

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, peeling, or chipping.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MULTIPANEL FOLDING ALUMINUM-FRAMED GLASS DOORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Euro-Wall Systems, LLC; Euro-C2 Aluminum Folding Door System or a comparable product by, but not limited to, one of the following:
 1. Arcadia Inc.
 2. LaCantina Doors; a division of JELD-WEN.
 3. Nana Wall Systems, Inc.
- B. Multipanel Folding Aluminum-Framed Glass Doors: Provide extruded-aluminum-framed multipanel folding glass doors, complete with glazing, threshold, flashings, support, and anchorage devices.
 1. Application: Interior, inward opening.
 2. Stack Storage Configuration: As shown on Drawings.
 3. Door Panel Design: Medium stile (3-1/5 inch); factory fabricated, field assembled.

2.2 GLAZING

- A. Glass and Glazing:
 1. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.
 2. Safety Glazing Labeling: Permanently mark safety glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label must indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
 3. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - a. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
 - b. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - c. Interlayer Color: Clear unless otherwise indicated.
- B. Clear Laminated Glass: Provide glazing units consisting of two plies of fully tempered float glass.
 1. Nominal Thickness: 1/2 inch.
 2. Minimum Thickness of Each Glass Ply: 6 mm.
 3. Interlayer Thickness: 0.030 inch.

4. Safety glazing required.

C. Glazing Gaskets: Dry glazing system compression type design, replaceable; EPDM, complying with ASTM C 864, with solid strand cord to prevent shrinkage or; Elastomeric silicone with solid strand cord to prevent shrinkage, complying with ASTM C 1115, as provided by the manufacturer.

1. Manufacturer's standard wedge gaskets black color.
2. Wet glazing on oversized panels.

D. Setting Blocks, Edge Blocks, and Spacers: As required by manufacturer and compatible with insulated glass where required.

2.3 HARDWARE

A. Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with door panels and other components, and complying with AAMA 907. Provide hardware designed to smoothly operate, tightly close, and securely lock multipanel folding aluminum-framed glass doors. Size hardware to accommodate panel weights and dimensions. Provide full-perimeter weatherstripping for each door panel.

B. Panel Support System: Provide panel support system designed for size, weight, and performance requirements of multipanel folding aluminum-framed glass doors indicated. Provide carriers with sealed ball bearings.

1. Overhead Supported: Provide multiwheeled overhead carriers suspended from steel or aluminum track, with lower guide system engaged in threshold for smooth operation. Limit track deflection to no more than 0.10 inch between supports when fully loaded.
2. Adjustment: Provide panel support system capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.
3. Threshold Configuration: Extruded-aluminum threshold with low profile, compliant with United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines."

a. Aluminum Finish: Clear anodized.

C. Panel Hinges: Aluminum, multileaf hinge with clear anodized finish. Provide integral hangers and guides for hinges that engage panel support system.

D. Locking System:

1. Primary Entrance Panel: Provide manufacturer's standard keyed multipoint locking device, with lever handles on the interior and exterior that operate dead bolt and concealed top and bottom rods.
2. Door Handles: Satin aluminum finish.
3. Cylinders: As specified in Section 087100 "Door Hardware."

2.4 ACCESSORIES

A. Trim: Provide interior and exterior casings, jamb extensions, and other components in material and finish to match door frames.

- B. Fasteners: Noncorrosive and compatible with door members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- C. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for multipanel folding aluminum-framed glass doors, complying with ASTM B456 or ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

2.5 FABRICATION

- A. 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.
- B. Fabricate components true to detail and free from defects impairing appearance, strength or durability.
- C. Fabricate components to allow for accurate and rigid fit of joints and corners. Match components carefully ensuring continuity of line and design. Ensure joints and connections will be flush and weathertight. Ensure slip joints make full, tight contact and are weathertight.
- D. Reinforce components at anchorage and support points, at joints, and at attachment points for interfacing work. Door panel corner key for strength and security.
- E. Glass: Accurately size glass to fit openings allowing clearances following recommendations of the manufacturer.
- F. Cut glass clean and carefully. Nicks and damaged edges will not be accepted. Replace glass that has damaged edges.

2.6 GENERAL FINISH REQUIREMENTS

- A. 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.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.
- B. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight hinged-door installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing multipanel folding aluminum-framed glass doors, hardware, accessories, and other components.
- B. Install multipanel folding aluminum-framed glass doors level, plumb, square, true to line; without distortion, warp, or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.
- C. Set threshold members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING

- A. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.
- B. Adjust hardware and operable panels to function smoothly, and lubricate as recommended by manufacturer.

3.4 CLEANING

- A. Clean exposed surfaces immediately after installation. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.5 PROTECTION

- A. Protect multipanel folding aluminum-framed glass door surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately according to manufacturer's written instructions.
- B. Refinish or replace folding aluminum-framed glass doors with damaged finishes.

END OF SECTION 083513.13

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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. Storefront framing.
- 2. Manual-swing entrance doors.
- 3. Column closures in storefront runs to match adjacent framing.

- B. Related Requirements:

- 1. Section 081216 "Aluminum Frames" for interior aluminum framing.
- 2. Section 087100 "Door Hardware" for entrance door hardware specification.

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.

- b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door, as well as procedures and diagrams. Coordinate final entrance door schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door.
- F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Source quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 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: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing venting windows and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. 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.
- C. Structural Loads:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
- E. Structural: Test according to ASTM E 330/E 330M 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.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 2. Entrance Doors:
 - a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- H. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- I. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas as a system shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas as a system shall have SHGC of no greater than 0.40 as determined according to NFRC 200.
 3. Condensation Resistance: Fixed glazing and framing areas as a system shall have an NFRC-certified condensation resistance rating of no less than 55 as determined according to NFRC 500.
- J. 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.
- 2.3 STOREFRONT SYSTEMS
- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America; an Arconic company; Trifab 451/451T or comparable product by one of the following:
1. Arcadia, Inc.
 2. EFCO Corporation.
 3. Manko Window Systems, Inc.
 4. Oldcastle BuildingEnvelope.
 5. Tubelite Inc.

6. U.S. Aluminum; a brand of C.R. Laurence.

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: Clear anodic finish.
6. Fabrication Method: Field-fabricated stick system.
7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
8. Steel Reinforcement: As required by manufacturer.

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.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: As indicated on Drawings.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

2.5 ENTRANCE DOOR HARDWARE

A. General: Provide heavy-duty entrance door hardware as specified in Section 087100 "Door Hardware" for each entrance door, with the exception of cylinders and card readers.

1. Cylinders shall be provided under Section 087100 for keying into the building system.
2. Card readers at security doors shall be provided under Division 28.

B. The aluminum entrances sub-contractor shall be responsible for providing complete, functional and code-compliant door hardware conforming to School District standards, as scheduled in Section 087100.

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: Comply with Section 088000 "Glazing."

2.7 MATERIALS

- A. Sheet and Plate: ASTM B 209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
- C. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
- D. Structural Profiles: ASTM B 308/B 308M.
- E. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
 - 4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.8 ACCESSORIES

- A. Automatic Door Operators: 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.
 - 3. Conceal fasteners wherever possible. Where not possible, use exposed fasteners with countersunk Phillips screw heads, fabricated from 300 series stainless steel.
- B. 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 A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Dead-soft, 0.018-inch-thick stainless steel, complying with ASTM A 240/A 240M, of type recommended by manufacturer.
- D. Miscellaneous Trim: Provide interior sill, exterior sills, closures, flashings, trim and other elements in conjunction with or adjacent to storefront system. Fabricate from 0.060 inch thick minimum aluminum finished to match other components, except fabricate interior and exterior sills from 0.125 inch thick minimum aluminum.

- E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior interior for vision glass and exterior for spandrel glazing or metal panels.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door.
 - 1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- D. Entrance Doors: Reinforce doors as required for installing entrance door.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- E. Entrance Door Hardware Installation: Factory install entrance door to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door before applying finishes.
- F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door according to entrance door manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: 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.

SECTION 084329 - SLIDING STOREFRONTS

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: Sliding Storefronts, including perimeter trims, and accessories.
- B. Related Sections:
 - 1. Section 079200 "Joint Sealants."
 - 2. Section 084113 "Aluminum-Framed Entrances and Storefronts" for swing doors
 - 3. Section 087100 "Door Hardware."
 - 4. Section 088000 "Glazing."

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance:
 - 1. Provide aluminum sliding storefronts which have been manufactured, fabricated and installed to withstand the specified uniform loads and to maintain the manufacturer's performance criteria without defects, damage or failure.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of sliding storefronts indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.
- C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.
- D. Samples for Verification: For sliding storefronts and components required.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of sliding storefronts. Test results based on use of downsized test units will not be accepted.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating sliding storefronts that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.
- C. Source Limitations: Obtain sliding storefront through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of sliding storefronts and are based on the specific system indicated. Do not modify size and dimensional requirements.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup for type(s) of sliding storefront(s) indicated, in location(s) shown on Drawings.
- F. Pre-installation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of sliding storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.7 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
 - 1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Kawneer Company Inc.; Series 1010 Sliding Mall Front, or comparable product by one of the manufacturers listed in Section 084113 "Aluminum-Framed Entrances and Storefronts."
 - 1. Framing Member Profile: 1-3/4 inches.

2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by sliding storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than **0.070 inch** wall thickness at any location for the main frame and sash members.
- B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with sliding storefront members, trim hardware, anchors, and other components.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- E. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
 - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
- F. Sealant: For sealants required within fabricated sliding storefront, provide sliding storefront manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.3 GLAZING

- A. Glass: Comply with Section 088000 "Glazing" for requirements applicable to safety glazing.
- B. Glazing System: Glazing method shall be a channel type PVC gasket (marine glazed) which is compatible with aluminum and shall be resistant to deterioration by all forms of weathering and suitably retained to maintain a watertight seal between the glass and the surrounding frame.

2.4 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock sliding storefronts.
- B. Standard Hardware:
 - 1. One pair of stainless steel tandem rollers per sliding panel.
 - 2. Stainless steel roller track.
 - 3. Adams Rite MS 1850A-505 Hookbolt Lock.
 - 4. Refer to Section 087100 "Door Hardware" for cylinders installed on room side and corridor side of sliding storefronts.
 - 5. Flush Face Pulls.

2.5 FABRICATION

A. General:

1. Fabricate Components per the Manufacturer's most current Installation Instruction manuals with minimum suggested clearances and shim spacing around the perimeter of the assembly while enabling installation and dynamic movement of the perimeter seal.
2. Accurately fit and secure all joints and corners. Make joints flush, hairline and waterproof.
3. Prepare frames to receive anchor devices as required.
4. When possible, arrange fasteners and attachments to conceal from view.
5. Shop assemble frames to the greatest extent possible and shop seal all horizontal to vertical joints.

2.6 FINISHES, GENERAL

- A. Comply with AAMA-AFPA "Anodic Finishes/Painted Aluminum" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, I Clear Anodic Coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances.
1. Proceed with installation only after unsatisfactory conditions have been corrected.
- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing sliding storefronts, hardware, accessories, and other components.
- B. Install sliding storefronts level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

- D. Install sliding storefronts and components to drain condensation, water penetrating joints, and moisture migrating within sliding storefront to the exterior.
- E. Separate aluminum from dissimilar materials to prevent corrosion or electrolytic action at points of contact.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating door panels, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather tight closure. Lubricate hardware and moving parts.
- B. Clean aluminum surfaces immediately after installing sliding storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean factory-glazed glass immediately after installing sliding storefronts. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect sliding storefront surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor sliding storefront surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, mortar, alkaline deposits, stains, or other contaminants. If contaminating substances do contact sliding storefront surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 084329

SECTION 084523 - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes aluminum-framed assemblies incorporating fiberglass-sandwich panels as follows:

1. Skylight assemblies.

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, dimensions of individual components and profiles, and finishes for aluminum components of panel assemblies.

- B. Shop Drawings: For panel assemblies.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.

- C. Samples: In manufacturer's standard size.

1. For each type of fiberglass-sandwich panel.
2. For each type of exposed finish for framing members.

- D. Fabrication Samples: Of each framing system intersection and adjacent panels, made from 12-inch lengths of full-size framing members and showing details of the following:

1. Joinery.
2. Anchorage.
3. Expansion provisions.
4. Fiberglass-sandwich panels.
5. Flashing and drainage.

- E. Delegated Design Submittals: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and manufacturer.
- B. Product Test Reports: For each fiberglass-sandwich-panel assembly, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For fiberglass-sandwich-panel assemblies from ICC-ES.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: For fiberglass-sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICC-ES AC04 or ICC-ES AC177.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies 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. Deterioration of metals and other materials beyond normal weathering.
 - c. Water leakage.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace fiberglass-sandwich panels that exhibit defects in materials or workmanship within specified warranty period.
 - 1. Defects include, but are not limited to, the following:
 - a. Fiberbloom.
 - b. Delamination of coating, if any, from exterior face sheet.
 - c. Color change exceeding requirements.
 - d. Delamination of panel face sheets from panel cores.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design fiberglass-sandwich-panel assemblies.
- B. Structural Loads: As indicated on Drawings.
- C. Deflection Limits:
 1. Vertical Panel Assemblies: Limited to 1/60 of clear span for each assembly component.
 2. Overhead Panel Assemblies: Limited to 1/60 of clear span for each assembly component.
- D. Structural-Test Performance: Provide panel assemblies tested in accordance with ASTM E330, as follows:
 1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and 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: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested in accordance with ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
- F. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F , ambient; 180 deg F , material surfaces.
- G. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:
 1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas to have U-factor of not more than 0.29 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas to have a SHGC of no greater than 0.31 as determined in accordance with NFRC 200.
 3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined in accordance with ASTM E283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.

2.2 FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

- A. Fiberglass-Sandwich-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with fiberglass-sandwich panels.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kalwall Corporation.
 - b. Major Industries, Inc.

2.3 FIBERGLASS-SANDWICH PANELS

- A. Fiberglass-Sandwich Panels: Uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core.
- B. Panel Thickness: 2-3/4 inches.
- C. Grid Core: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of 7/16 inch.
 - 1. Extruded Aluminum: ASTM B221, in alloy and temper recommended in writing by manufacturer.
 - 2. I-Beam Construction: Thermally broken, extruded aluminum.
 - 3. Grid Pattern: Inline rectangle, nominal 12 by 24 inches.
- D. Exterior Face Sheet:
 - 1. Thickness: 0.070 inch.
 - 2. Color: Crystal.
 - 3. Protective Weathering Surface: Manufacturer's standard.
- E. Interior Face Sheet:
 - 1. Thickness: 0.045 inch.
 - 2. Color: White.
- F. Fiberglass-Sandwich-Panel Adhesive: Manufacturer's standard for permanent adhesion of facings to cores.
- G. Panel Strength:
 - 1. Maximum Panel Deflection: 3-1/2 inches when a 4-by-12-foot panel is tested in accordance with ASTM E72 at 34 lbf/sq. ft., with a maximum 0.090-inch set deflection after five minutes.
 - 2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf concentrated load when applied to a 3-inch- diameter disk in accordance with ASTM E661.
- H. Panel Performance:
 - 1. Self-Ignition Temperature: 650 deg F or more in accordance with ASTM D1929.
 - 2. Smoke-Developed Index: 450 or less in accordance with ASTM E84, or 75 or less in accordance with ASTM D2843.

3. Combustibility Classification: Class CC1 based on testing in accordance with ASTM D635.
4. Roof-Covering Classification: Class B in accordance with ASTM E108 or UL 790.
5. Color Change: Not more than 3.0 units Delta E, when measured in accordance with ASTM D2244, after outdoor weathering compliant with procedures in ASTM D1435.
 - a. Outdoor Weathering Conditions: Sixty months in southern Florida.
6. Impact Resistance: No fracture or tear at impact of 60 ft. x lbf by a 3-1/4-inch- diameter, 5-lb freefalling ball in accordance with UL 972 test procedure.
7. Haze Factor: Greater than 90 percent when tested in accordance with ASTM D1003.

2.4 ALUMINUM FRAMING SYSTEMS

- A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
 1. Construction: Thermally broken, extruded aluminum.
- B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 1. Sheet and Plate: ASTM B209.
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
 3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
 4. Structural Profiles: ASTM B308/B308M.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
- D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
 1. At closures, retaining caps, or battens, use ASTM A193/A193M, 300 series stainless steel screws.
 2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- F. Anchor Bolts: ASTM A307, Grade A, galvanized steel.
- G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- H. Exposed Flashing and Closures: Aluminum sheet not less than 0.040 inch thick, finished to match framing.
- I. Framing Gaskets: Manufacturer's standard.
- J. Frame-System Sealants: As recommended in writing by manufacturer.

- K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

A. Frame System Fabrication:

- 1. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Internal guttering systems or other means to drain water passing through joints, and moisture migrating within assembly to exterior.
- 2. Fabricate sill closures with weep holes and for installation as continuous component.
- 3. Reinforce components as required to receive fastener threads.

B. Panel Fabrication: Factory assemble and seal panels.

- 1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.
 - a. White spots indicating lack of bond at intersections of grid-core members are limited in number to four for every 40 sq. ft. of panel and limited in diameter to 3/64 inch.
- 2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
- 3. Fabricate panel to allow condensation within panel to escape.
- 4. Reinforce panel corners.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine 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. General: Comply with manufacturer's written instructions.
 - 1. Do not install damaged components.
 - 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - 3. Rigidly secure nonmovement joints.

4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
 5. Seal joints watertight unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install components plumb and true in alignment with established lines and elevations.
- D. Skylight Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Locate weep holes at rafters. Install components to drain water passing through joints and moisture migrating within assembly to exterior.
- E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 084523

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Section 061000 "Rough Carpentry."
2. Section 079200 "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
3. Section 081113 "Hollow Metal Doors and Frames."
4. Section 081416 "Flush Wood Doors."
5. Section 084113 "Aluminum-Framed Entrances and Storefronts."
6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives

3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
 - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.

- b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
5. Key Schedule:
- a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
- C. Informational Submittals:
- 1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
 - 2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.
- D. Closeout Submittals:
- 1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
 - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. Fire door assemblies, in compliance with NFPA 80.
 - b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
3. Electrified Door Hardware

- a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- 4. Accessibility Requirements:
 - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.
- C. Pre-Installation Meetings
 - 1. Keying Conference
 - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.
 - 2. Pre-installation Conference
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
 - f. Review questions or concerns related to proper installation and adjustment of door hardware.
 - 3. Electrified Hardware Coordination Conference:
 - a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - a) Schlage ND Series: 10 years
 - 2) Exit Devices
 - a) Von Duprin: 10 years
 - 3) Closers
 - a) LCN 4000 Series: 30 years
 - 4) Automatic Operators
 - a) LCN: 2 years
 - b. Electrical Warranty
 - 1) Locks
 - a) Schlage: 3 years
 - 2) Exit Devices
 - a) Von Duprin: 3 years

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 - 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

- A. Fabrication
 - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
 - 2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- C. Cable and Connectors:
 - 1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
 - 2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.

3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
2. Acceptable Manufacturers and Products:
 - a. Hager BB1191/1279 series
 - b. McKinney TB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:

- a. Select
- b. Best
- c. Hager

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin EPT-10
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Rockwood
 - b. Hager

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage ND series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
 - a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
 - b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Provide messages color-coded with full text and symbol, as scheduled, for easy visibility.
 - e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
3. Cylinders: Refer to "KEYING" article, herein.
4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Provide electrified options as scheduled in the hardware sets.
9. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Vandlgard: Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
 - b. Lever Design: RHODES(RHO)

2.08 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin 98/35A series

2. Acceptable Manufacturers and Products:
 - a. No Substitute

- B. Requirements:
 1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
 2. Cylinders: Refer to "KEYING" article, herein.
 3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
 4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
 5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
 6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
 7. Provide flush end caps for exit devices.
 8. Provide exit devices with manufacturer's approved strikes.
 9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
 10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
 11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
 12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
 13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
 14. Provide electrified options as scheduled.
 15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
 16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
 17. Special Options:
 - a. SI
 - 1) Provide dogging indicators for visible indication of dogging status.
 - b. XP
 - 1) Rim Exit Devices: provide devices with non-tapered smart latchbolt with 90° latchbolt to strike engagement under stress and Static Load Resistance of 2000 pounds.
 - c. QM
 - 1) Rim Exit Devices: provide devices with damper-controlled re-latching to reduce operational noise. Where lever trim is specified, provide damper controlled lever return.
 - d. HH
 - 1) Provide wind and impact rated hurricane exit devices and mullions certified to comply with Florida Building Code (FBC) TAS 201, 202, 203.
 - e. HW
 - 1) Provide wind rated hurricane exit devices and mullions certified to comply with ANSI-ASTM E330.
 - f. CX

- 1) Provide delayed egress devices, where scheduled, that are UL 294 listed, meet National Fire Protection Association (NFPA) and International Building Code (IBC) governing delayed egress, and/or other local and national fire codes acceptable to authority having jurisdiction as required.
 - a) Provide non-handed and field sizeable device with 3/4 (19mm) throw deadlocking latch bolt. Device incorporates an internal RX switch that detects attempt to exit from applying less than 15lbs to the push pad, which causes this switch to start an irreversible alarm cycle. Key switch in device is capable of arming, disarming, or resetting the device; and indicator lamp determines status of the device.
 - b) Provide devices capable of standard 15 second release delay and indefinite release delay as required by code, when tied into fire alarm system will release immediately when an alarm condition exists.
 - c) Provide devices with all control inputs – door position input, external inhibit input, fire alarm input; auxiliary locking; nuisance alarm and internal horn; and, remote signaling output self-contained in the device assembly.
- g. CVC
 - 1) Provide cable-actuated concealed vertical latch system in two-point for non-rated or fire rated wood doors up to a 90 minute rating and less bottom latch (LBL) configuration for non-rated or fire rated wood doors up to 20 minute rating. Vertical rods not permitted.
 - a) Cable: Stainless steel with abrasive resistant coating. Conduit and core wire ends snap into latch and center slides without use of tools.
 - b) Wood Door Prep: Maximum 1 inch x 1.1875 inch x 3.875 inches top latch pocket and 1 inch x 1.1875 inch x 5 inches bottom latch pocket which does not require the use of a metal wrap or edge for non-rated or fire rated wood doors up to a 45 minute rating.
 - c) Latchbolts and Blocking Cams: Manufactured from sintered metal low carbon copper- infiltrated steel, with molybdenum disulfide low friction coating.
 - d) Top Latchbolt: Minimum 0.38 inch (10 mm) and greater than 90-degree engagement with strike to prevent door and frame separation under high static load.
 - e) Bottom Latchbolt: Minimum of 0.44-inch (11 mm) engagement with strike.
 - f) Product Cycle Life: 1,000,000 cycles.
 - g) Latch Operation: Top and bottom latch operate independently of each other. Top latch fully engages top strike even when bottom latch is compromised. Separate trigger mechanisms not permitted.
 - h) Latch release does not require separate trigger mechanism.
 - i) Cable and latching system characteristics:
 - i. Installed independently of exit device installation, and capable of functioning on door prior to device and trim installation.
 - ii. Connected to exit device at single point in steel and aluminum doors, and two points for top and bottom latches in wood doors.
 - iii. Bottom latch height adjusted, from single point for steel and aluminum doors and two points for wood doors, after system is installed and connected to exit device, while door is hanging
 - iv. Bottom latch position altered up and down minimum of 2 inches (51 mm) in steel and aluminum doors without additional adjustment. Bottom latch deadlocks in every adjustment position in wood doors.
 - v. Top and bottom latches in steel and aluminum doors and top latch in wood doors may be removed while door is hanging.

2.09 ELECTRONIC ACCESS CONTROL LOCKSETS AND EXIT DEVICE TRIM

- A. Manufacturers:
 - 1. Scheduled Manufacturer and Product:
 - a. Schlage AD Series
 - 2. Acceptable Manufacturers and Products:
 - a. No Substitute
- B. Requirements:
 - 1. Provide adaptable electronic access control products that comply with the following requirements:
 - a. Listed, UL 294 - The Standard of Safety for Access Control System Units.
 - b. Compliant with ANSI/BHMA A156.25 Grade 1 Operation and Security.
 - c. Certified to UL10C, FCC Part15, Florida Building Code Standards TAS 201 large missile impact, TAS 202 and TAS 203.
 - d. Compliant with ASTM E330 for door assemblies.
 - e. Compliant with ICC / ANSI A117.1, NFPA 101, NFPA 80, and Industry Canada IC.
 - 2. Functions: Provide functions as scheduled that are field configurable without taking the adaptable electronic product off the door.
 - 3. Emergency Override: Provide mechanical key override; cylinders: Refer to "KEYING" article, herein.
 - 4. Levers:
 - a. Vandal Resistance: Exterior (secure side) lever rotates freely while door remains locked, preventing damage to internal lock components from vandalism by excessive force.
 - b. Provide non-handed lever trim that operates independently of non-locking levers.
 - c. Style: <INSERT LEVER DESIGN>
 - d. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
 - 5. Features:
 - a. Audible feedback that can be enabled or disabled.
 - b. Tamper-Resistant Screws: Tamper torx screws on inside escutcheon for increased security.
 - c. Visual tri-colored LED indicators that indicate activation, additional PIN code credential required, operational systems status, system error conditions and low power conditions.
 - d. Door Position Switch
 - e. Interior Cover Tamper Guard
 - f. Mechanical Key Override
 - g. Request to Exit
 - h. Request to Enter
 - i. Lock/Unlock Status
 - 6. Credential Reader
 - a. Credential Reader Configuration: Provide credential reader modules in the following configurations as indicated in door hardware sets.
 - b. Credential Reader Capabilities: Provide credential readers capable of operating with the following integrated software partners.
 - 1) 13.56 MHz Smart card credentials:
 - a) Secure section (Multi-Technology and Smartcard): Schlage MIFARE Classic, Schlage MIFARE DESFire EV1/EV3, PIV and PIV-I Compatible

- b) 13.56 MHz Serial number only (Multi-Technology and Smartcard): MIFARE, DESFire, HID iClass, MIFARE DESFire EV1/EV3
 - c) 125 kHz Proximity card credentials: Schlage, XceedID, HID, GE/CASI ProxLite and AWID.
 - 2) Multi-Technology readers that read both 13.56 MHz Smart Cards and 125 kHz Prox cards.
 - 3) Dual credential reading capabilities credential card or fob and PIN.
 - 4) 12 button keypad with backlit buttons.
 - 5) Magnetic Card Reader:
 - a) Full insertion or swipe reader capable of reading information along full length of magnetic stripe.
 - b) Magnetic card triple track reader capable of reading tracks 1, 2 or 3 per configuration in field.
7. Operation:
- a. Offline – access control rights stored on device
 - 1) Provide adaptable electronic access control products with the ability to be configured at door by handheld programming device the length of time device is unlocked upon access grant.
 - 2) Provide adaptable electronic access control products with the ability to communicate identifying information such as firmware versions, hardware versions, serial numbers, and manufacturing dates by handheld programming device.
 - b. Networked – hardwired
 - 1) Adaptable electronic access control product system interface:
 - 2) Adaptable electronic access control products to have real-time bidirectional communication between access control system and lock.
 - 3) Credential Verification Time: less than 1 second.
 - 4) When Utilized with Partner Integrated Access Control Network Software with Remote Commanding Capability: Provide adaptable electronic access control product with the ability to be remotely locked down or unlocked within 10 seconds or less, without user interface at the device.
 - 5) Upon Loss of Power to Device: Provide adaptable electronic access control product with the ability to manage access control offline in one of three methods below that can be configured in the field at lockset by handheld programming device and remotely by Partner integrated software:
 - a) Fail locked (secured)
 - b) Fail unlocked (unsecured)
 - c) Fail As-Is
 - 6) Upon Loss of Communication Between Device and Network: Provide adaptable electronic access control product with the ability to manage access control offline in one of four methods below that can be configured in the field at device by handheld programming device and remotely by Partner integrated software:
 - a) Fail locked (secured)
 - b) Fail unlocked (unsecured)
 - c) Fail As-Is
 - d) Fail to Degraded/cache mode utilizing cache memory with following selectable options:
 - i. Grant access up to the last 1,000 unique previously accepted User IDs.
 - ii. Grant access up to the last 1,000 unique previously accepted facility/site codes.
 - iii. Remove from cache previously stored User IDs or facility/site codes that have not been presented to lock within the last 5 days.

- 7) Provide adaptable electronic access control product with the ability to be configured at door by handheld programming device and remotely by Partner integrated software the length of time device is unlocked upon access grant.
- 8) Provide adaptable electronic access control product with the ability to communicate identifying information such as firmware versions, hardware versions, serial numbers, and manufacturing dates by handheld programming device and remotely by Partner integrated software.
- c. Networked – wireless
 - 1) Adaptable electronic access control product system interface:
 - 2) Adaptable electronic access control products to have real-time bidirectional communication between access control system and lock.
 - 3) Remote Commanding By Partner Integrated Access Control Network Software: Battery-powered lockset shall have "Wake on Radio" feature causing activation of remote, wireless access control devices, enabling activated devices to be configured, locked or unlocked from a centralized location within 10 seconds or less without user interface at the device.
 - 4) Local Commanding: Provide adaptable electronic access control product with the ability to be configured, locked or unlocked locally by handheld programming device, in real-time.
 - 5) When Utilized with Access Control Network Software with Remote Commanding Capability: Provide adaptable electronic access control product with the ability to be remotely locked down or unlocked within 10 seconds or less while battery powered without user interface at the device.
 - 6) Real-time response of battery powered device capable of being configured at door by handheld programming device and remotely by Partner integrated software.
 - 7) Upon Loss of Power to Device: Provide adaptable electronic access control product with the ability to manage access control offline in one of three methods below that can be configured in the field at device by handheld programming device and remotely by Partner integrated software:
 - a) Fail locked (secured)
 - b) Fail unlocked (unsecured)
 - c) Fail As-Is
 - 8) Upon Loss of Communication Between Device and Network: Provide adaptable electronic access control product with the ability to manage access control offline in one of four methods below that can be configured in the field at lockset by handheld programming device and remotely by Partner integrated software:
 - a) Fail locked (secured)
 - b) Fail unlocked (unsecured)
 - c) Fail As-Is
 - d) Fail to Degraded/cache mode utilizing cache memory with following selectable options:
 - i. Grant access up to the last 1,000 unique previously accepted User IDs.
 - ii. Grant access up to the last 1,000 unique previously accepted facility/site codes
 - iii. Remove from cache previously stored User IDs or facility/site codes that have not been presented to lock within the last 5 days.
 - 9) Provide adaptable electronic access control product with the ability to be configured at door by handheld programming device and remotely by Partner integrated software the length of time device is unlocked upon access grant.
 - 10) Provide adaptable electronic access control product with the ability to communicate identifying information such as firmware versions, hardware versions, serial numbers, and manufacturing dates by handheld programming device and remotely by Partner integrated software.
 - 11) Wireless Transmission:

- a) Modulation: 900 MHz spread spectrum, direct sequence, 10 channels.
- b) Encryption: AES-128-bit Key minimum.

C. Components

1. Product: Schlage HHD series with Utility Software. (OFFLINE)
 - a. Provide Handheld Programming Device for adaptable electronic access control products capable of the following minimum requirements.
 - 1) Capable of initializing lock and accessories using preloaded software.
 - 2) Utilized to field configure electronic access control devices, to download firmware updates and door files to device, and to download audit files from device.
2. Provide Panel Interface for adaptable electronic access control products.
 - a. Product: Schlage PIB300-2D Panel Interface Board. (AD-300)
 - b. Product: Schlage PIM400-485 or PIM400-TD2 Panel Interface Module as required. (AD-400)
 - c. Product: Schlage PIM400-1501 Panel Interface Module. (AD-400)

2.10 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage/Von Duprin PS900 Series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
 - a. 12/24 VDC Output, field selectable.
 - b. Class 2 Rated power limited output.
 - c. Universal 120-240 VAC input.
 - d. Low voltage DC, regulated and filtered.
 - e. Polarized connector for distribution boards.
 - f. Fused primary input.
 - g. AC input and DC output monitoring circuit w/LED indicators.
 - h. Cover mounted AC Input indication.
 - i. Tested and certified to meet UL294.
 - j. NEMA 1 enclosure.
 - k. Hinged cover w/lock down screws.
 - l. High voltage protective cover.

2.11 CYLINDERS

A. Manufacturers: **VERIFY WITH OWNER**

1. Scheduled Manufacturer and Product:
 - a. SCHALGE

B. Requirements:

1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.12 KEYING

A. Scheduled System: **VERIFY WITH OWNER**

1. New factory registered system:
 - a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
2. Existing factory registered system:
 - a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:
 - a. Temporary Construction Cylinder Keying.
 - 1) Provide construction cores that permit voiding construction keys without cylinder removal, furnished in accordance with the following requirements.
 - a) Split Key or Lost Ball Construction Keying System.
 - b) 3 construction control keys, and extractor tools or keys as required to void construction keying.
 - c) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will void operation of temporary construction keys.
 - b. Replaceable Construction Cores.
 - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a) 3 construction control keys
 - b) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.
2. Permanent Keying:
 - a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Owner.
 - b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).

- 3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
- d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Architect and Owner.
 - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
 - 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
- e. Quantity: Furnish in the following quantities.
 - 1) Permanent Control Keys: 3.
 - 2) Master Keys: 6.
 - 3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
 - 4) Key Blanks: Quantity as determined in the keying meeting.

2.13 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Telkee
2. Acceptable Manufacturers:
 - a. HPC
 - b. Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
 - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.

2.14 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4040XP series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
11. Closers shall be capable of being upgraded by adding modular mechanical or electronic components in the field.

2.15 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4600 series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide drop plates, brackets, and adapters for arms as required for details.
6. Provide actuator switches and receivers for operation as specified.
7. Provide weather-resistant actuators at exterior applications.

8. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
9. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
10. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.16 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.17 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.18 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
 - a. Glynn-Johnson
 2. Acceptable Manufacturers:
 - a. No Substitute
- B. Requirements:
1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.19 DOOR STOPS AND HOLDERS

- A. Manufacturers:
1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood
- B. Provide door stops at each door leaf:
1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
 2. Where a wall stop cannot be used, provide universal floor stops.
 3. Where wall or floor stop cannot be used, provide overhead stop.
 4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.20 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

- A. Manufacturers:
1. Scheduled Manufacturer:
 - a. Zero International
 2. Acceptable Manufacturers:
 - a. National Guard
 - b. Pemko
- B. Requirements:
1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
 2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.21 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Rockwood
 - b. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.22 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Schlage
2. Acceptable Manufacturers:
 - a. GE-Interlogix
 - b. Sargent

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.23 COAT HOOKS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Rockwood

B. Provide coat hooks as specified.

2.24 FINISHES

- A. FINISH: BHMA 626/652 (US26D); EXCEPT:
 - 1. Hinges at Exterior Doors: BHMA 630 (US32D)
 - 2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
 - 3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
 - 4. Protection Plates: BHMA 630 (US32D)
 - 5. Overhead Stops and Holders: BHMA 630 (US32D)
 - 6. Door Closers: Powder Coat to Match
 - 7. Wall Stops: BHMA 630 (US32D)
 - 8. Latch Protectors: BHMA 630 (US32D)
 - 9. Weatherstripping: Clear Anodized Aluminum
 - 10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 - 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Replace construction cores with permanent cores as indicated in keying section.
 - 3. Furnish permanent cores to Owner for installation.
- J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Connections to panel interface modules, controllers, and gateways.
 - 6. Testing and labeling wires with Architect's opening number.
- K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- L. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.
- M. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- N. Overhead Stops/holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- O. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- P. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- Q. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- R. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

- S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- T. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.



3.04 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to 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.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

Legend:





-  Link to catalog cut sheet
-  Electrified Opening

Hardware Group No. 01

For use on Door #(s):

A130 A133 B136

Provide each SGL door(s) with the following:







QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	VANDL OFFICE LOCK	ND91 RHO (VERIFY KEYWAY)		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 02

For use on Door #(s):

A117 A118 A119 A123 A124 A125
A127 A128

Provide each SGL door(s) with the following:







QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	VANDL OFFICE LOCK	ND91 RHO (VERIFY KEYWAY)		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	SET	GASKETING	870AA-S		AA	ZER
1	EA	DOOR BOTTOM	364AA		AA	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER

Hardware Group No. 03

For use on Door #(s):

A112 A122 A131 A138-A B123-B B125-A
B126-A B127

Provide each SGL door(s) with the following:







QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	VANDL OFFICE LOCK W/ INSIDE INDICATOR	ND91P6D RHO IS-LOC		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 04

For use on Door #(s):

A157 B103-B B103-C B105

Provide each SGL door(s) with the following:





QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	VANDL CLASSROOM LOCK	ND94 RHO (VERIFY KEYWAY)		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 05

For use on Door #(s):

A106 A107 A113 A114-A A114-B A115
A129 A143 A152 B101 B106 B109
B111 B112 B113 B114 B117

Provide each SGL door(s) with the following:







QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	VANDL OFFICE LOCK	ND91 RHO (VERIFY KEYWAY)		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 06

For use on Door #(s):

A109 A121-A A121-B A134 A135 A137-A
A137-B A151 B116 B124 B129-B B130
B133







Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	VANDL STOREROOM LOCK	ND96 RHO (VERIFY KEYWAY)		626	SCH
1	EA	SURFACE CLOSER	4040XP TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 07

For use on Door #(s):
B123-A

Provide each SGL door(s) with the following:






QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	VANDL CLASSROOM LOCK	ND94 RHO (VERIFY KEYWAY)		626	SCH
1	EA	OH STOP	90S		689	GLY
1	EA	SURFACE CLOSER	4040XP TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 08

For use on Door #(s):

A101 A120 A136 A145 B131 B132

Provide each SGL door(s) with the following:








QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	SET GASKETING	488SBK		BK	ZER
1	EA	COAT AND HAT HOOK	582		626	IVE

Hardware Group No. 09

For use on Door #(s):

A149 A150

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PUSH PLATE	8200 6" X 16"		630	IVE
1	EA	PULL PLATE	8303 10" 6" X 16"		630	IVE
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 10

For use on Door #(s):

A132-A A132-B A140-A B128-A B128-B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-L-NL-06-CON 24 VDC		⚡ 626	VON
1	EA	RIM CYLINDER	AS REQUIRED		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON-XX AS REQUIRED		⚡	SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR		⚡ BLK	SCE
1	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED		⚡ 628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR		⚡	VON

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RETRACTS LATCH TO ALLOW ENTRY OR BY KEY.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

Hardware Group No. 11

For use on Door #(s):
A139

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	VANDL EU STOREROOM	ND96EU RHO RX CON 12V/24V DC (VERIFY KEYWAY)		⚡ 626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
2	EA	WIRE HARNESS	CON-XX AS REQUIRED		⚡	SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR		⚡ BLK	SCE
1	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED		⚡ 628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR		⚡	VON

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY UNLOCKS LEVER TO
ALLOW ENTRY OR BY KEY.
INSIDE LEVER ALWAYS ALLOWS EGRESS.

Hardware Group No. 12

For use on Door #(s):

A146 A147 B134

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	⚡	689	VON
1	EA	VANDL EU STOREROOM	ND96EU RHO RX CON 12V/24V DC (VERIFY KEYWAY)	⚡	626	SCH
1	EA	SURFACE CLOSER	4040XP TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
2	EA	WIRE HARNESS	CON-XX AS REQUIRED	⚡		SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR	⚡	BLK	SCE
1	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED	⚡	628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR	⚡		VON

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY UNLOCKS LEVER TO
ALLOW ENTRY OR BY KEY.
INSIDE LEVER ALWAYS ALLOWS EGRESS.

Hardware Group No. 13

For use on Door #(s):

A140-B B135-A B137

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	157XY		628	IVE
1	EA	POWER TRANSFER	EPT10 CON	⚡	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-XP98-NL-CON 24 VDC	⚡	626	VON
1	EA	RIM CYLINDER	AS REQUIRED		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER
2	EA	WIRE HARNESS	CON-XX AS REQUIRED	⚡		SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR	⚡	BLK	SCE
1	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED	⚡	628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR	⚡		VON

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RETRACTS LATCH TO
ALLOW ENTRY OR BY KEY.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

Hardware Group No. 14

For use on Door #(s):

A103

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	VANDL OFFICE LOCK	ND91 RHO (VERIFY KEYWAY)		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 15

For use on Door #(s):
A104

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	ELEC CLASSROOM LOCK	AD-200-CY-70-KP-RHO-P6-RH 4AA BATTERY		626	SCE
1	EA	OH STOP	90S		689	GLY
1	EA	SURFACE CLOSER	4040XP TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 16

For use on Door #(s):
A141

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	VANDL OFFICE LOCK	ND91 RHO (VERIFY KEYWAY)		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 17

For use on Door #(s):
A144








Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	VANDL STOREROOM LOCK	ND96 RHO (VERIFY KEYWAY)		626	SCH
1	EA	OH STOP	90S		689	GLY
1	EA	SURFACE CLOSER	4040XP TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 18

For use on Door #(s):
A142






Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	98-L-NL-06		626	VON
1	EA	RIM CYLINDER	AS REQUIRED		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 19

For use on Door #(s):
B138







Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	VANDL STOREROOM LOCK	ND96 RHO (VERIFY KEYWAY)		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 20

For use on Door #(s):
A110-A A111 A116 A126 A148 B102






Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	VANDL STOREROOM LOCK	ND96 RHO (VERIFY KEYWAY)		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 21

For use on Door #(s):
B129-A





Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	INSTITUTION LOCK	ND82 RHO(VERIFY KEYWAY)		626	SCH
1	EA	SURFACE CLOSER	4040XP HW/PA TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 22

For use on Door #(s):
B110 B115








Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	VANDL STOREROOM LOCK	ND96 RHO (VERIFY KEYWAY)		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 23

For use on Door #(s):
B120 B121

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
2	EA	MANUAL FLUSH BOLT	FB358 / FB458 AS REQ'D BY DOOR MATERIAL		626	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED		626	IVE
1	EA	VANDL STOREROOM LOCK	ND96 RHO (VERIFY KEYWAY)		626	SCH
2	EA	OH STOP	90S		689	GLY
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 24

For use on Door #(s):
B122

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
2	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-L-DT-06-CON 24 VDC		⚡ 626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-L-NL-06-CON 24 VDC		⚡ 626	VON
1	EA	MULLION STABILIZER	154		SP28	VON
1	EA	MORTISE CYLINDER	AS REQUIRED		626	SCH
1	EA	RIM CYLINDER	AS REQUIRED		626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CCV		630	IVE
2	EA	MULLION SEAL	8780NBK PSA		BK	ZER
2	EA	SILENCER	SR64		GRY	IVE
4	EA	WIRE HARNESS	CON-XX AS REQUIRED		⚡	SCH
2	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED		⚡ 628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR		⚡	VON










DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
ACCESS CONTROL SYSTEM MAY HAVE LATCH RETRACTED DURING OPEN HOURS TO ALLOW FREE PUBLIC ENTRY.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

Hardware Group No. 25

For use on Door #(s):

B119-B B119-C B119-E

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
2	EA	PANIC HARDWARE	LD-98-L-2SI-06		626	VON
1	EA	MULLION STABILIZER	154		SP28	VON
3	EA	MORTISE CYLINDER	AS REQUIRED		626	SCH
2	EA	RIM CYLINDER	AS REQUIRED		626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CCV		630	IVE
2	SET	GASKETING	870AA-S		AA	ZER
2	EA	DOOR SWEEP	39A		A	ZER

Hardware Group No. 26

For use on Door #(s):
B135-E

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
2	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-L-DT-06-CON 24 VDC		⚡ 626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-L-NL-06-CON 24 VDC		⚡ 626	VON
1	EA	MULLION STABILIZER	154		SP28	VON
1	EA	MORTISE CYLINDER	AS REQUIRED		626	SCH
1	EA	RIM CYLINDER	AS REQUIRED		626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CCV		630	IVE
2	EA	MULLION SEAL	8780NBK PSA		BK	ZER
2	EA	SILENCER	SR64		GRY	IVE
4	EA	WIRE HARNESS	CON-XX AS REQUIRED		⚡	SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR		⚡ BLK	SCE
2	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED		⚡ 628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR		⚡	VON

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RETRACTS LATCH TO ALLOW ENTRY OR BY KEY.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

Hardware Group No. 27

For use on Door #(s):
B125-B B126-B

Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	MORTISE CYLINDER	AS REQUIRED		626	SCH
1			HARDWARE BY MANUFACTURER			

Hardware Group No. AL01

For use on Door #(s):
A105

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	157XY		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-XP98-NL-OP-110MD- CON 24 VDC		⚡ 626	VON
1	EA	RIM CYLINDER	AS REQUIRED		626	SCH
1	EA	OFFSET PULL	8190HD 10"		630	IVE
1	EA	OH STOP	100S ADJ		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	SET	SEALS	BY DOOR / FRAME MANUFACTURER			
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER
1	EA	WIRE HARNESS	CON-XX AS REQUIRED		⚡	SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR		⚡ BLK	SCE
1	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED		⚡ 628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR		⚡	VON

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RETRACTS LATCH TO
ALLOW ENTRY OR BY KEY.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

Hardware Group No. AL02

For use on Door #(s):

A110-B A154

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	157XY		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	VANDL EU STOREROOM	ND96EU RHO RX CON 12V/24V DC (VERIFY KEYWAY)		⚡ 626	SCH
1	EA	LOCK GUARD	LG12		630	IVE
1	EA	OH STOP	100S ADJ		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	SET	SEALS	BY DOOR / FRAME MANUFACTURER			
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER
2	EA	WIRE HARNESS	CON-XX AS REQUIRED		⚡	SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR		⚡ BLK	SCE
1	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED		⚡ 628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR		⚡	VON

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY UNLOCKS LEVER TO
ALLOW ENTRY OR BY KEY.
INSIDE LEVER ALWAYS ALLOWS EGRESS.

Hardware Group No. AL03

For use on Door #(s):
B103-A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	157XY		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	VANDL EU STOREROOM	ND96EU RHO RX CON 12V/24V DC (VERIFY KEYWAY)		⚡ 626	SCH
1	EA	OH STOP	100S ADJ		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	SET	SEALS	BY DOOR / FRAME MANUFACTURER			
2	EA	WIRE HARNESS	CON-XX AS REQUIRED		⚡	SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR		⚡ BLK	SCE
1	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED		⚡ 628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR		⚡	VON

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY UNLOCKS LEVER TO
ALLOW ENTRY OR BY KEY.
INSIDE LEVER ALWAYS ALLOWS EGRESS.

Hardware Group No. AL04

For use on Door #(s):
A108 A155 B118

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	157XY		628	IVE
1	EA	VANDL OFFICE LOCK	ND91 RHO (VERIFY KEYWAY)		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	SET	SEALS	BY DOOR / FRAME MANUFACTURER			

Hardware Group No. AL05

For use on Door #(s):

A100 B100-B

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	157XY		628	IVE
2	EA	POWER TRANSFER	EPT10 CON	⚡	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-XP98-EO-CON 24 VDC	⚡	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-XP98-NL-OP-110MD- CON 24 VDC	⚡	626	VON
1	EA	MULLION STABILIZER	154		SP28	VON
1	EA	MORTISE CYLINDER	AS REQUIRED		626	SCH
1	EA	RIM CYLINDER	AS REQUIRED		626	SCH
2	EA	OFFSET PULL	8190HD 10"		630	IVE
2	EA	OH STOP	100S ADJ		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
2	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	SET	SEALS	BY DOOR / FRAME MANUFACTURER			
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER
4	EA	WIRE HARNESS	CON-XX AS REQUIRED		⚡	SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR	⚡	BLK	SCE
2	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED	⚡	628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR	⚡		VON

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RETRACTS LATCH TO
ALLOW ENTRY OR BY KEY.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

Hardware Group No. AL06

For use on Door #(s):
B119-A

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	157XY		628	IVE
2	EA	POWER TRANSFER	EPT10 CON	⚡	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-EO-CON 24 VDC	⚡	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP-110MD-CON 24 VDC	⚡	626	VON
1	EA	MULLION STABILIZER	154		SP28	VON
1	EA	MORTISE CYLINDER	AS REQUIRED		626	SCH
1	EA	RIM CYLINDER	AS REQUIRED		626	SCH
2	EA	OFFSET PULL	8190HD 10"		630	IVE
2	EA	OH STOP	100S ADJ		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
2	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	SET	SEALS	BY DOOR / FRAME MANUFACTURER			
4	EA	WIRE HARNESS	CON-XX AS REQUIRED		⚡	SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR	⚡	BLK	SCE
2	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED	⚡	628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR	⚡		VON

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RETRACTS LATCH TO
ALLOW ENTRY OR BY KEY.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

Hardware Group No. AL07

For use on Door #(s):
B100-A

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	157XY		628	IVE
2	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-XP98-EO-CON 24 VDC		⚡ 626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-XP98-NL-OP-110MD- CON 24 VDC		⚡ 626	VON
1	EA	MULLION STABILIZER	154		SP28	VON
1	EA	MORTISE CYLINDER	AS REQUIRED		626	SCH
1	EA	RIM CYLINDER	AS REQUIRED		626	SCH
2	EA	OFFSET PULL	8190HD 10"		630	IVE
1	EA	OH STOP	100S ADJ		630	GLY
1	EA	OH STOP	100SE ADJ		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA TBWMS		689	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS 120 VAC		⚡ 689	LCN
1	EA	ACTUATOR PKG	8310-3857T		630	LCN
1	EA	WEATHER RING	8310-801			LCN
2	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	SET	SEALS	BY DOOR / FRAME MANUFACTURER			
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER
4	EA	WIRE HARNESS	CON-XX AS REQUIRED		⚡	SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR		⚡ BLK	SCE
2	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED		⚡ 628	SCE
1	EA	POWER / LOW VOLTAGE POWER	BY SECURITY CONTRACTOR		⚡	VON

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RETRACTS LATCH TO
ALLOW ENTRY OR BY KEY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER TO ALLOW ADA PUSH BUTTON TO
ACTIVATE AUTO OPERATOR AND OPEN DOOR INSIDE ADA PUSH BUTTON ALWAYS ACTIVE.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

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Bid No. 25KP03
Jordan School District

MHTN Project No. 2024528
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Hardware Group No. OH01

For use on Door #(s):

B119-F B135-B B135-C B135-D

Provide each RU door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1		HARDWARE BY MANUFACTURER		

END OF SECTION

SECTION 088000 - GLAZING

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. Glass for windows, doors, interior borrowed lites and storefront framing.
 - 2. Glazing sealants and accessories.

1.3 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 according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of the following products; 12 inches square.

1. Coated glass.
2. Insulating glass.

- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer glass testing agency and sealant testing agency.
- B. Product Certificates: For glass.
- C. Product Test Reports: For insulating glass, 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. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 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.

1.10 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 the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cardinal Glass Industries.
 - 2. Guardian Glass; SunGuard.
 - 3. Viracon, Inc.
 - 4. Vitro.

- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.
 2. Design Snow Loads: As indicated on Drawings.
 3. 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.
 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.
- F. Roller Wave Distortion of Heat-Treated Glass: Limit roller wave (peak to valley) to 0.003 inch maximum at middle of the glass and 0.008 inch within 10.5 inches of the edges.
1. Limit maximum bow/warp tolerances to one-half the values indicated in ASTM C1048.

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 IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
1. Minimum Glass Thickness for Exterior Lites: 6 mm.

- E. 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 C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary sealant and silicone secondary sealant.
 - 2. Perimeter Spacer: Manufacturer's standard spacer material and construction Aluminum with mill or clear anodic finish Aluminum with black, color anodic finish Aluminum with bronze, color anodic finish Aluminum with powdered metal paint finish in color selected by Architect Galvanized steel Stainless steel Polypropylene-covered stainless steel in color selected by Architect Thermally broken aluminum Nonmetallic laminate Nonmetallic tube Silicone with integral desiccant and vapor barrier Insert material.
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

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. Sealant shall have a VOC content of 250 g/L or less.

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."
 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." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 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."
 7. 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.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, 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. Dow Corning Corporation; Dowsil 795.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.; Silpruf
 - c. Tremco Incorporated; Spectrum 2.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
1. EPDM, silicone or neoprene with a Shore A durometer hardness of 85, plus or minus 5.
 2. Type recommended by sealant or glass manufacturer.
- D. Spacers:
1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 2. Type recommended by sealant or glass manufacturer.
- E. Edge Blocks:

1. EPDM, silicone, or neoprene with a Shore A durometer hardness per manufacturer's written instructions.
 2. Type recommended by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- 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.

3.6 MONOLITHIC GLASS SCHEDULE

- A. Glass Type A01: Clear annealed float glass.
 - 1. Minimum Thickness: 6 mm (1/4 inch).
- B. Glass Type T01: Clear fully tempered float glass.
 - 1. Minimum Thickness: 6 mm (1/4 inch).
 - 2. Safety glazing required.

3.7 INSULATING GLASS SCHEDULE

- A. Low-E-Coated, Clear Insulating Glass Type H22, Heat-Strengthened:
 - 1. Basis-of-Design Product: Guardian SN 68; Vitro Solarban 60.
 - 2. Overall Unit Thickness: 1 inch.
 - 3. Minimum Thickness of Each Glass Lite: 6 mm.
 - 4. Outdoor Lite: Heat-strengthened float glass.

5. Interspace Content: Air.
6. Indoor Lite: Clear heat-strengthened float glass.
7. Low-E Coating: Pyrolytic on second surface.
8. Winter Nighttime U-Factor: 0.29 (air) maximum.
9. Summer Daytime U-Factor: 0.27 (air) maximum.
10. Visible Light Transmittance: 70 percent minimum.
11. Solar Heat Gain Coefficient: 0.38 maximum.

B. Low-E-Coated, Clear Insulating Glass Type T22, Tempered:

1. Basis-of-Design Product: Guardian SN 68; Vitro Solarban 60.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Fully tempered float glass.
5. Interspace Content: Air.
6. Indoor Lite: Clear fully tempered float glass.
7. Low-E Coating: Pyrolytic on fourth surface.
8. Winter Nighttime U-Factor: 0.29 (air) maximum.
9. Summer Daytime U-Factor: 0.27 (air) maximum.
10. Visible Light Transmittance: 70 percent minimum.
11. Solar Heat Gain Coefficient: 0.38 maximum.

C. Ceramic -Coated, Low-E, Insulating Spandrel Glass Type T24, Tempered:

1. Basis-of-Design Product: Match vision glass.
2. Coating Color: As selected by Architect from manufacturer's full range.
3. Overall Unit Thickness: 1 inch.
4. Minimum Thickness of Each Glass Lite: 6 mm.
5. Outdoor Lite: Clear fully tempered float glass.
6. Interspace Content: Air.
7. Indoor Lite: Clear fully tempered float glass.
8. Low-E Coating: Sputtered on second surface.
9. Opaque Coating Location: Fourth surface.

END OF SECTION 088000

SECTION 08 8400 - PLASTIC GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Monolithic polycarbonate glazing.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for plastic glazing during and after installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Plastic Glazing Samples: For each color and finish of plastic glazing indicated, 12 inches square and of same thickness indicated for final Work.
- C. Glazing Accessory Samples: For each type of mounting hardware.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For plastic glazing and glazing products.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For plastic glazing to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect plastic glazing materials according to manufacturer's written instructions. Prevent damage to plastic glazing and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Maintain protective coverings on plastic glazing to avoid exposures to abrasive substances, excessive heat, and other sources of possible deterioration.

1.7 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 components are wet from rain, frost, condensation, or other causes.

1.8 WARRANTY

- A. Manufacturer's Special Warranty for Abrasion- and UV-Resistant, Monolithic Polycarbonate: Manufacturer agrees to replace polycarbonate products that break or develop defects from normal use that are attributable to manufacturing process and not to practices for maintaining and cleaning plastic glazing contrary to manufacturer's written instructions. Defects include coating delamination, haze, excessive yellowing, and loss of light transmission beyond the limits stated in plastic glazing manufacturer's standard form.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Plastic glazing sheets and glazing materials shall withstand normal temperature changes, wind, and impact loads without failure, including loss or breakage of plastic sheets attributable to the following: failure of sealants or gaskets to remain watertight and airtight, deterioration of plastic sheet and glazing materials, or other defects in materials and installation.
- B. Safety Glazing: Plastic glazing shall comply with 16 CFR 1201, Category II.
 - 1. Labeling: Permanently mark plastic glazing with certification label of an agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of plastic, thickness, and safety glazing standard with which plastic glazing complies.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on plastic glazing and glazing framing members.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Fire-Test-Response Characteristics of Plastic Glazing: As determined by testing plastic glazing by a qualified testing agency acceptable to authorities having jurisdiction.
 - 1. Self-ignition temperature of 650 deg F or higher when tested according to ASTM D1929 on plastic sheets in thicknesses indicated for the Work.
 - 2. Smoke density of 75 or less when tested according to ASTM D2843 on plastic sheets in thicknesses indicated for the Work.
 - 3. Burning extent of 1 inch or less when tested according to ASTM D635 at a nominal thickness of 0.060 inch or thickness indicated for the Work.
 - 4. Flame-spread index of not less than that indicated when tested according to ASTM E84.

2.2 PLASTIC GLAZING, GENERAL

- A. Glazing Publication: Comply with published instructions of plastic glazing manufacturers and

with GANA's "Glazing Manual" unless more stringent requirements are indicated. See this publication for definitions of glazing terms not otherwise defined in this Section or in other referenced standards.

- B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.

2.3 MONOLITHIC POLYCARBONATE GLAZING

- A. Plastic Glazing, Polycarbonate Sheet Type PG- (#): ASTM C1349, Appendix X1, Type I (standard, UV stabilized), with a polished finish.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide 3form, Inc.; Koda XT or comparable product by, but not limited to, one of the following, approved prior to bidding:
 - a. Altuglas International, Division of Arkema Inc.
 - b. Amerilux International, LLC
 - c. Covestro LLC
 - 2. Nominal Thickness: 1/2 inch.
 - 3. Color: As selected by Architect from manufacturer's full range.
 - 4. Combustibility Class: CC1.
 - 5. Flame-Spread Index: 75 or less.

2.4 MISCELLANEOUS GLAZING MATERIALS

- A. Compatibility: Provide products of material, size, and shape complying with requirements of manufacturers of plastic glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Hardware: Manufacturer's exterior rated hardware, suitable for attachment to the supporting structure.
 - 1. Material: Stainless steel, Type 316.
 - 2. Type: Barrel stand-off with cap, washers and anchors.
 - 3. Size: 1-1/2 inches diameter by 2 inches long.

2.5 FABRICATION

- A. Sizes: Fabricate plastic glazing to sizes required for openings indicated. Allow for thermal expansion and contraction of plastic glazing without restraint and without withdrawal of edges from frames, with edge clearances and tolerances complying with plastic glazing manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plastic glazing framing, with glazing Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Minimum required face or edge clearances.
3. Effective sealing between joints of plastic glazing framing members.

B. Proceed with glazing only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members immediately before glazing. Remove coatings not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of plastic glazing materials, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publication.

B. Sand or scrape cut edges of plastic glazing to provide smooth edges, free of chips and hairline cracks.

C. Protect plastic glazing surfaces from abrasion and other damage during handling and installation, according to the following requirements:

1. Retain plastic glazing manufacturer's protective covering or protect by other methods according to plastic glazing manufacturer's written instructions.
2. Remove covering at border of each piece before glazing; remove remainder of covering immediately after installation where plastic glazing is exposed to sunlight or where other conditions make later removal difficult.
3. Remove damaged plastic glazing sheets from Project site and legally dispose of off-site. Damaged plastic glazing sheets are those containing imperfections that, when installed, result in weakened glazing and impaired performance and appearance.
4. Anchor mounting hardware to structure, drill, and install panels in hardware per manufacturer's written instructions.
 - a. Install at spacing indicated, adjusted as required to comply with IBC, currently adopted edition, load requirements for exterior applications.
 - b. Do not overtighten caps and damage panels. Panels damaged during fabrication or installation will be rejected.

3.4 CLEANING AND PROTECTION

A. Protect plastic glazing from contact with contaminating substances from construction operations. If, despite such protection, contaminating substances do come into contact with plastic glazing, remove immediately and wash plastic glazing according to plastic glazing manufacturer's written instructions.

B. Remove and replace plastic glazing that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

C. Wash plastic glazing on both faces before date scheduled for inspections intended to establish

date of Substantial Completion in each area of Project. Wash plastic glazing according to plastic glazing manufacturer's written instructions.

END OF SECTION 08 8400

SECTION 088700 - SECURITY GLAZING FILMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Security glazing film applied to new glazing assemblies.

1.3 CODES AND REFERENCES:

- A. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
- B. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
- C. EN356 P4 – Testing and Classification of Resistance Against Manual Attack.
- D. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
- E. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Glazing film manufacturer specializing in manufacture of security glazing films with minimum 10 years successful experience.
- B. Impact Resistance: Provide independent test data indicating the following:
 - 1. Comply with 16 CFR 1201 Category 2 and ANSI Z97.1 Class A, Unlimited, when applied to 1/4 inch annealed glass.
- C. Bomb Blast Mitigation: Provide independent test data indicating the following:
 - 1. GSA Rating of “2” (Minimal Hazard) / ASTM F 1642 “Minimal Hazard” with blast pressure of 10 psi and 89 psi msec blast impulse, on 1 inch annealed insulated glass unit.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each film product to be used, minimum size 4 inches by 6 inches, representing actual product, color, and patterns.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Detailed reports of full-scale chamber tests to specified criteria, using assemblies identical to those required for this project.
- B. Sample warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufactures unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent—based materials, in accordance with requirements of authorities having jurisdiction.

1.8 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

- A. Provide 10 year manufacturers replacement warranty to cover film against peeling, cracking, discoloration, and deterioration.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide 3M Scotchshield Safety and Security Film; Ultra S800 or comparable products from one of the following:
 - 1. Flexvu Films.
 - 2. Llumar Safety and Security Films; manufactured by Eastman Chemical Company.
 - 3. Madico, Inc.

2.2 MATERIALS

- A. Security Glazing Film:

1. Optically clear polyester film with acrylic abrasion resistant coating on one side, adhesive on the other for permanent bonding to glass.
 2. Thickness: 0.008 inches (8 mils).
 3. Adhesive Type: UV stabilized, pressure sensitive.
 4. Tensile Strength (Base Film): ASTM D-882, 32,000 psi minimum.
 5. Breaking Strength (Base Film): ASTM D-882, 190 lbs. / inch.
 6. Elongation at Break (Base Film): ASTM D-882, 110 percent.
 7. Visible Light Transmission: 88 percent, applied to 1/4 inch clear glass.
 8. Solar Heat Gain Coefficient: 0.80 maximum, applied to 1/4 inch clear glass.
 9. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84 (Class A).
- B. Anchoring System: 3M Impact Protection adhesive attachment system, or other system approved by manufacturer, to meet forced entry resistance requirements, applied to all sides of opening.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field-Applied Film: Verify that existing conditions are adequate for proper application and performance of film.
- B. Examine glass and frames, insure that existing conditions are adequate for proper application and performance of film.
- C. Verify glass is not cracked, chipped, broken, or damaged.
- D. Verify that frames are securely anchored and free of defects.

3.2 PREPARATION

- A. Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.
- B. Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.
- C. Protect adjacent surfaces.
- D. Do not begin installation until substrates have been properly prepared.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps, as required to achieve specified performance.
- B. Accurately cut film with straight edges to required sizes allowing 1/16-inch to 1/8-inch gap at perimeter of glazed panel unless otherwise required by anchorage method.
- C. Seams. Seam film only as required to accommodate material sizes; seam without overlaps.

- D. Clean glass prior to film installation with neutral cleaning solution.
- E. Peel back release liner and apply film to glass. Using squeegees, push out solution between film and glass.
- F. Once film is installed, anchor the edges of the film by applying approved structural sealant and high impact styrene to the edges of the frames and film.
- G. Clean glass and excess structural sealants from finished surfaces
- H. Remove any labels or protective covers.

3.4 FILM VERIFICATION

- A. Testing by Manufacturer: Manufacturer's representative will choose at random, three pieces of glass, which will be removed and film applied will be measured to verify that film installed meets specifications as requested. Film may need to be removed as part of the verification process.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 088700

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Non-load-bearing steel framing systems for interior partitions.
- 2. Suspension systems for interior ceilings and soffits.
- 3. Grid suspension systems for gypsum board ceilings.

- B. Related Requirements:

- 1. Provide steel stud ceiling framing where indicated in the Drawings, complying with requirements of this section for non-structural metal framing and with Section 054000 "Cold-Formed Metal Framing" where structural metal framing is required.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- B. Horizontal Deflection: For composite and non-composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft..

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for steel unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C 645.
 - 1. Steel Studs and Tracks:
 - 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) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich Building Systems.
 - 3) MarinoWARE.
 - b. Minimum Base-Steel Thickness: 0.0329 inch.
 - c. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide the following:
 - 1. 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. Products: available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) CEMCO; California Expanded Metal Products Co.; SLP-TRK Slotted Deflection Track.
 - 2) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
 - 3) Metal-Lite; The System.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: 0.0635 inch.
- E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.
 1. Depth: 1-1/2 inches.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base-Steel Thickness: 0.0296 inch.
 2. Depth: As indicated on Drawings unless indicated otherwise on Drawings.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Armstrong World Industries, Inc; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; 640/660 Drywall Ceiling Suspension.
 - c. United States Gypsum Company; Drywall Suspension System.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks 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. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 5. 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. 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.

3.5 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.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Do not attach hangers to steel roof deck.
 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. 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 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
- B. Related Requirements:
 - 1. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written 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 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Ceiling and wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

- A. Regional Materials: Products shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 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. American Gypsum.
 - b. CertainTeed Corporation.
 - c. Georgia-Pacific Building Products.
 - d. National Gypsum Company.
 - e. USG Corporation.
 2. Thickness: 5/8 inch.
 3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

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. National Gypsum Company; PermaBASE Cement Board.
 - b. USG Corporation; Durock Brand Cement Board.
2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

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 setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backing Panel: As recommended by backing panel manufacturer.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- C. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than Insert value percent.
- D. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.

- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. 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. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: As indicated on Drawings.
 - 2. Abuse-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
 - 3. L-Bead: Use where edge trim can only be installed after gypsum panels are installed.
 - 4. U-Bead: Use where indicated.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Cementitious Panels: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor tile.
2. Resin based terrazzo tile.
3. Wall tile.
4. Thresholds.
5. Waterproof membranes.
6. Crack isolation membranes.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for cementitious tile backing panels.

1.2 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Module Size: Actual tile size plus joint width indicated.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
1. Product Data: For adhesives, indicating VOC content.
 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch lengths.
5. Metal edge strips in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and grouting products.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Build mockup of each type of floor tile installation.
 2. Build mockup of each type of wall tile installation.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

- B. Store tile and glass-mat materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 - 2. Obtain waterproof membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Stone thresholds.
 - 2. Waterproof membrane.
 - 3. Crack isolation membrane.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so that tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

- A. Resin Base Terrazzo Tile, **Type FT1, TB1**.
 - 1. Basis-of-Design: Basis-of-Design Product: Subject to compliance with requirements, provide Tilebar; Terrazzo Italy or comparable product approved prior to bidding.
 - 2. Face Size: As indicated in the Finish Schedule Legend.
 - 3. Thickness: 12 mm.
 - 4. Dynamic Coefficient of Friction: Not less than 0.42.
 - 5. Tile Color, Glaze, and Pattern: As indicated by manufacturer's designations.
 - 6. Grout Color: As selected by Architect from manufacturer's full range.
- B. Factory-Mounted Mosaic Tile **Type FT2**: Glazed Ceramic Mosaic.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide DalTile; Portfolio or comparable product by one of the following:
 - a. American Marazzi Tile, Inc.
 - b. American Olean; a division of Dal-Tile Corporation.
 - c. Crossville, Inc.
 - d. Interceramic.
 - 2. Face Size: 2 by 2 factory mounted mosaic.
 - 3. Thickness: 1/4 inch
 - 4. Dynamic Coefficient of Friction: Not less than 0.42.
 - 5. Tile Color, Glaze, and Pattern: As indicated by manufacturer's designations.
 - 6. Grout Color: As selected by Architect from manufacturer's full range.
- C. Porcelain Tile, **Type TB2**: Colorbody Porcelain.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide DalTile; Portfolio, or comparable product by one of the following:
 - e. American Marazzi Tile, Inc.
 - f. American Olean; a division of Dal-Tile Corporation.
 - g. Crossville, Inc.
 - h. Interceramic.
 - 2. Size: As indicated in the Finish Schedule Legend.
 - 3. Tile Color, Glaze, and Pattern: As indicated by manufacturer's designations.
 - 4. Grout Color: As selected by Architect from manufacturer's full range.
- D. Porcelain Tile **Type WT1**:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Crossville, inc. Java Joint, or comparable product by one of the following:
 - a. American Marazzi Tile, Inc.

- b. American Olean; a division of Dal-Tile Corporation.
 - c. Crossville, Inc.
 - d. Daltile.
 - e. Interceramic.
 2. Face Size: As indicated in the Finish Schedule Legend.
 3. Thickness: 5/16.
 4. Finish: Unpolished.
 5. Tile Color and Pattern: As indicated by manufacturer's designations.
 6. Grout Color: As selected by Architect from manufacturer's full range.
- E. Porcelain Tile **Type WT2**: Colorbody Porcelain.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile; Portfolio, or comparable product by one of the following:
 - f. American Marazzi Tile, Inc.
 - g. American Olean; a division of Dal-Tile Corporation.
 - h. Crossville, Inc.
 - i. Interceramic.
 2. Face Size: As indicated in the Finish Schedule Legend.
 3. Thickness: 5/16 inch.
 4. Tile Color and Pattern: As indicated by manufacturer's designations.
 5. Grout Color: As selected by Architect from manufacturer's full range.
- F. Ceramic Tile **Type WT3, WT5**: Colorbody Porcelain.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile; Portfolio, or comparable product by one of the following:
 - j. American Marazzi Tile, Inc.
 - k. American Olean; a division of Dal-Tile Corporation.
 - l. Crossville, Inc.
 - m. Daltile.
 - n. Interceramic.
 2. Face Size: As indicated in the Finish Schedule Legend.
 3. Thickness: 3/8 inch.
 4. Edge: Non-rectified.
 5. Tile Color and Pattern: As indicated by manufacturer's designations.
 6. Grout Color: As selected by Architect from manufacturer's full range.
- G. Mosaic Tile **Type WT6**: Colorbody Porcelain.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile; Acreage Linear Deco, or comparable product by one of the following:
 - o. American Marazzi Tile, Inc.
 - p. American Olean; a division of Dal-Tile Corporation.
 - q. Crossville, Inc.
 - r. Interceramic.
 2. Face Size: As indicated in the Finish Schedule Legend.

3. Thickness: 5/16 inch.
4. Tile Color and Pattern: As indicated by manufacturer's designations.
5. Grout Color: As selected by Architect from manufacturer's full range.

H. Ceramic Tile **Type WT7**: Colorbody Porcelain.

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Marazzi tile, Inc.; Zellige Neo, or comparable product by one of the following:
 - s. American Marazzi Tile, Inc.
 - t. American Olean; a division of Dal-Tile Corporation.
 - u. Crossville, Inc.
 - v. Daltile.
 - w. Interceramic.
2. Face Size: As indicated in the Finish Schedule Legend.
3. Thickness: 3/8 inch.
4. Tile Color and Pattern: As indicated by manufacturer's designations.
5. Grout Color: As selected by Architect from manufacturer's full range.

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Granite Thresholds: ASTM C615/C615M, with honed Insert finish finish.
1. Description:
 - a. Uniform, fine-grained, gray stone without veining.

2.5 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Waterproof Membrane, Fabric-Reinforced, Fluid-Applied: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik, Inc; Hydroment Blacktop 90210.
 - b. Custom Building Products; Custom® 9240 Waterproofing and Anti-Fracture Membrane.
 - c. Laticrete International, Inc.; LATICRETE 9235 Waterproofing Membrane.
 - d. Summitville Tiles, Inc.; S-9000.

2.6 CRACK ISOLATION MEMBRANES

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Crack Isolation Membrane, Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.
 - 1. Products: 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. Noble Company (The); Nobleseal CIS.

2.7 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
 - 1. Cleavage Membrane: Asphalt felt, ASTM D 226/D 226M, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
 - 2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.
 - 3. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.
 - a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - 4. Latex Additive: Acrylic resin water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- B. Large and Heavy Tile Mortar (Thin set): ANSI A118.4 and ANSI 118.12.
 - 1. Available Products: Subject to compliance with requirements, provide the following product or comparable product from other manufacturers:
 - a. Custom Building Products; MegaLite Ultimate Crack Prevention Large Format Tile Mortar
- C. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.
 - 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. C-Cure.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

D. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.

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. Bonsal American, an Oldcastle company.
 - b. LATICRETE SUPERCAP, LLC.
 - c. MAPEI Corporation.
2. Verify adhesives have a VOC content of 130 g/L or less.

2.8 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3, with VOC content of 65 g/L or less.

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. Bostik, Inc.
 - b. C-Cure.
 - c. Custom Building Products.
 - d. Laticrete International, Inc.
 - e. MAPEI Corporation.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

B. Grout for PregROUTed Tile Sheets: Same product used in factory to pregrout tile sheets.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless steel, ASTM A276/A276M or ASTM A666, 300 Series exposed-edge material.

1. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - a. Blanke Corporation.
 - b. Ceramic Tool Company, Inc.
 - c. Schluter Systems L.P.

- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.10 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors consisting of tiles 8 by 8 inches or larger.
 - c. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with joint width recommended by manufacturer.
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in improved modified dry-set mortar (thinset).
 2. Do not extend waterproof membrane under thresholds set in improved modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on waterproof membrane with elastomeric sealant.
- K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- L. Floor Sealer: Apply floor sealer to cementitious grout joints according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- 3.4 INSTALLATION OF WATERPROOF MEMBRANE
- A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
 - B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.
- 3.5 INSTALLATION OF CRACK ISOLATION MEMBRANES
- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
 - B. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- 3.6 ADJUSTING AND CLEANING
- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
 - B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 1. Remove grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.7 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. TCNA F121: Method ANSI A108.1B. Bonded, cement mortar bed (thickset) on waterproof membrane.
 - a. Ceramic Tile Type: As indicated in Finish Schedule.
 - b. Bond Coat for Cured-Bed Method: Improved modified dry-set mortar; Large and Heavy tile mortar at large format tile (with any edge over 15 inches).
 - c. Grout: Water-cleanable epoxy grout.
 - 2. TCNA F 122A: Thinset mortar on waterproof membrane.
 - a. Ceramic Tile Type: All wall tile unless noted otherwise.
 - b. Thinset Mortar: Improved modified dry-set mortar.
 - c. Grout: Water-cleanable epoxy grout.
- B. Interior Wall Installations, Wood or Metal Studs, Cementitious backer board:
 - 1. TCNA W244C; Thinset mortar.
 - a. Ceramic Tile Type: As scheduled in Drawings.
 - b. Thinset Mortar: Modified dry-set mortar.
 - c. Grout: High-performance unsanded grout.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
- B. Products furnished, but not installed under this Section, include anchors, and clips.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For components with factory-applied finishes.
- C. Delegated-Design Submittal: For seismic restraints for ceiling systems.
 - 1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Ceiling suspension-system members.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Method of attaching hangers to building structure.
 - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 - 5. Size and location of initial access modules for acoustical panels.
 - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.

- e. Sprinklers.
 - f. Access panels.
 - g. Perimeter moldings.
 - 7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
 - 8. Minimum Drawing Scale: 1/8 inch = 1 foot .
 - B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
 - C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For finishes to include in maintenance manuals.
- 1.7 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
- 1.8 QUALITY ASSURANCE
- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of typical ceiling area as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 - B. Installer Qualifications: A qualified Installer that is approved, authorized, or licensed by manufacturer to install manufacturer's product.
- 1.9 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.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.
- B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS – **ACP1**

- A. Design Standard: Armstrong, Mesa, acoustical ceiling panels.
- B. Design Standards are used to establish a standard of quality for the work and are not intended to be a restraint of trade or limit of competition. Subject to compliance with requirements, provide the named product or a comparable approved product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corporation.
 - 3. United States Gypsum Company.
- C. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

- D. Classification: Provide panels as follows:
1. Type and Form: Type III: Mineral base with painted finish; Form 2.
 2. Pattern: CE, perforated, small holes and lightly textured.
 3. Color: As indicated in a schedule.
 4. Light Reflectance (LR): Not less than 0.85.
 5. Ceiling Attenuation Class (CAC): Not less than 35.
 6. Noise Reduction Coefficient (NRC): Not less than 0.60.
 7. Edge/Joint Detail: As indicated in a schedule.
 8. Size and Thickness: As indicated in a schedule.
- 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 in accordance with ASTM D3273, ASTM D3274, or ASTM G21 and evaluated in accordance with ASTM D3274 or ASTM G21.

2.4 METAL SUSPENSION SYSTEM DESIGN STANDARDS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated in the Finish Schedule Legend, a comparable approved product by one of the following:
1. Armstrong World Industries, Inc.
 2. CertainTeed Corporation.
 3. Chicago Metallic Corporation.
 4. United States Gypsum Company.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

2.5 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ceiling & Wall Solutions; Prelude, 15/16 inch Exposed Tee Grid System or a comparable product by one of the following:
1. CertainTeed; SAINT-GOBAIN.
 2. USG Corporation.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.
- 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: Heavy-duty system.
 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 3. Face Design: Flat, flush.
 4. Cap Material: Cold-rolled steel.

5. Cap Finish: Painted white.

2.6 ACCESSORIES

Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.
- C. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
- D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- F. Manufacturer's standard ceiling anchors, adjustable wire hangers and related accessories required for installation as shown on drawings.

2.7 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Armstrong World Industries, Inc.
 2. CertainTeed Corporation.
 3. Chicago Metallic Corporation.
 4. United States Gypsum Company.

- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
 - 1. Basis of Design Product: Armstrong, Axiom.
 - a. Height: 4 inches, unless indicated otherwise on Drawings.
 - b. Color: As selected from manufacturer's full range.
 - 2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils . Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.8 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
 - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

- F. 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. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 - 2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

3.6 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 095400 – WOOD PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes:

1. Wood veneer ceiling panels.
2. Concealed suspension system.
3. Wire hangers, fasteners, main runners, wall angle moldings and accessories.

B. Related Sections:

1. Section 092900 "Gypsum Board."
2. Section 095113 "Acoustical Panel Ceilings" for additional seismic suspension requirements and components.
3. Division 23 - HVAC
4. Division 26 - Electrical

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

B. Hardwood Plywood & Veneer Association (HPVA).

C. International Building Code.

D. ASHRAE Standard 62.1-2004 Ventilation for Acceptable Indoor Air Quality.

E. NFPA 70 National Electrical Code.

F. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures.

G. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components.

H. International Code Council-Evaluation Services Report - Seismic Engineer Report.

1. ESR 1308 - Armstrong T-Bar or Dimensional Suspension.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each type of ceiling unit and suspension system required.
- B. Installation Instructions: Submit manufacturer's installation instructions as referenced in Part 3, Installation.
- C. Samples: Minimum 12 by 18 inches samples of specified panel; 8 inch long samples of exposed wall molding and suspension system, including main runner.
- D. Shop Drawings: Illustrating the layout and details of the ceilings. Show locations of items that are to be coordinated with, or supported by the ceilings.
- E. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- F. All products not conforming to manufacturer's current published values must be removed and dispose. Replace with complying product at the expense of the Contractor performing the work.

1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide ceiling panel units and grid components by a single manufacturer.
- B. Fire Performance Characteristics: Identify ceiling components with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristics: As follows, tested by HPVA (Hardwood Plywood and Veneer Association) under the test standard ASTM E-84 tunnel test and complying with ASTM E 1264 for Class A products.
 - a. Flame Spread: 25 or less
 - b. Smoke Developed: 50 or less
- C. Woodworking Standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.
- D. Woodworks Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.
- E. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, wet work i.e. gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store the wood veneer ceiling panels in a dry interior location in their cartons prior to installation to avoid damage. Store the ceiling panel cartons in a flat, horizontal position. Do not remove the protectors between the panels until installation.
- B. Do not store in unconditioned spaces with humidity greater than 55 percent or lower than 25 percent relative humidity and temperatures lower than 50 degrees F or greater than 86 degrees F. Do not expose the wood veneer ceiling panels to extreme temperatures, for example, close to a heating source or near a window with direct sunlight.
- C. Handle ceiling units carefully to avoid chipped edges or damage to units in any way.

1.7 PROJECT CONDITIONS

- A. Prior to installation, the wood veneer ceiling materials are required to reach room temperature and have stabilized moisture content for a minimum of 72 hours.
- B. Do not install the wood veneer panels in spaces where the temperature or humidity conditions vary greatly from the temperatures and conditions that will be normal in the occupied space.
- C. As interior finish products, the wood veneer panels are designed for installation in temperature conditions between 50 degrees F and 86 degrees F, in spaces where the building is enclosed and HVAC systems are functioning and will be in continuous operation. Relative humidity should not fall below 25 percent or exceed 55 percent.

1.8 WARRANTY

- A. Wood Veneer Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:
 - 1. Ceiling Panels: Defects in materials or factory workmanship.
 - 2. Grid System: Rusting and manufacturing defects.
- B. Warranty Period:
 - 1. Wood veneer panels: One (1) year from date of installation.
 - 2. Grid: One (1) year from date of installation.
- C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.9 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of each type of the amount installed.
2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acoustic Plank Wood Panels: Subject to compliance with requirements, provide 9Wood, Inc.; Basis-of-Design panels and suspension systems or comparable product.

2.2 WOOD VENEER CEILING UNITS

- A. Acoustic Plank Wood Ceiling Panels Type - **ACP2**:
 1. Basis of Design Product: 9Wood, 3200.
 - a. Species: As indicated in Finish Schedule Legend; quarter sliced.
 - b. Size: As indicated in Finish Schedule Legend.
 - c. Edge Profile: As indicated in Finish Schedule Legend.
 - d. Groove Spacing: 8 mm centers.
 - e. Suspension Style: Tegral edge.
 - f. Finish: "Dressed-to-the-Nines" Clear Interior Finish.
 - g. Acoustic Backer: SoundTex Black Acoustic Scrim.
 - h. Flame Spread: Class 1A per ASTM E84.

2.3 METAL SUSPENSION SYSTEMS

- A. Components:
 1. Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
 - a. Structural Classification: ASTM C 635, Heavy Duty.
 - b. Color: Black.
 - c. Acceptable Product: Armstrong World Industries; PRELUDE XL 15/16 inch Exposed Tee or panel manufacturer approved equal.
 2. Attachment Devices:
 - a. Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
 3. Wire for Hangers and Ties:
 - a. ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.

- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- C. Suspension Accessories: Provide manufacture's clips, brackets and other components for a complete system, including those required for applications to vertical soffit walls.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out.
- B. Proper designs for both supply air and return air, maintenance of the HVAC filters and building interior space are essential to minimize soiling. Before starting the HVAC system, make sure supply air is properly filtered and the building interior is free of construction dust.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

3.3 INSTALLATION

- A. Install suspension system and panels in compliance with ASTM C636; CISCA Seismic Guidelines; approved construction drawings; with the authorities having jurisdiction; and in accordance with the manufacturer's installation instructions.
- B. Install wall moldings at intersection of suspended ceiling and vertical surfaces.

3.4 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095400

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoset-rubber base.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Product Schedule: For resilient base and accessory products.

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 - **RB1**

- A. Basis-of-Design Product: Subject to compliance with requirements, Roppe Corporation, USA; products as indicated in the Finish Schedule Legend, or a comparable product from one of the following:
 - 1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
 - 2. Johnsonite; A Tarkett Company.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style: Style B, Cove.
 - 2. Locations: Provide rubber base in areas indicated or as required for conditions.
- C. Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors: As indicated by manufacturer's designations.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until 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.

D. 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. Miter or cope corners to minimize open joints.

3.4 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 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. Rubber floor tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient floor tile.
 - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 2. Show details of special patterns.
- C. Samples: Full-size units of each color, texture, and pattern of floor tile required.
- D. Provide samples to Weber School District for approval.
- E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish 5 percent, or one box minimum, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.
 - a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

1.10 WARRANTY

- A. Special Warranty for Resilient Tiles: Manufacturer agrees to repair or replace components of resilient tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of resilient tile due to unusual traffic, failure of substrate, vandalism, or abuse.

2. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 - b. Installation defects.
 - 1) Installation warranty applies to flooring installed by a professional flooring installer pursuant to manufacturer's installation instructions.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
 2. Static Load: 1500 psi min. (ASTM F970).

2.2 RUBBER FLOOR TILE - **RT1, RT2**

- A. Basis of Design Products: Subject to compliance with requirements, provide Nora System, Inc.; Noraplan Environcare, or a comparable product by, but not limited to, one of the following:
 1. Flexco Corporation.
 2. Mannington Mills, Inc.
 3. Roppe Corporation; Roppe Holding Company.
- B. Tile Standard: ASTM F 1344.
 1. Grade: 1.
 2. Type: 1.
- C. Wearing Surface: Smooth
- D. Total Thickness: 2 mm.
- E. Size: As indicated on the Drawings.
- F. Colors and Patterns: As indicated on the Drawings.

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 F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated .
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain running in one direction .
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

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

SECTION 096815 – FLOOR PREPARATION FOR CARPET

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Floor preparation for carpet tile and accessories.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for Owner-furnished, Owner-installed material.
 - 2. Section 033000 "Cast-In-Place Concrete" for slab tolerances and finishes.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

1.4 QUALITY ASSURANCE

- A. Worker Qualifications: An experienced carpet mechanic or installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.5 PROJECT CONDITIONS

- A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

PART 2 - PRODUCTS

2.1 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or approved by carpet tile manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the Owner's carpet supplier.
 - 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 3. Drywall mud, paints, mastics adhesives and overspray are scraped down to bare slab to eliminate any conditions detrimental to carpet glue adhesion.
- C. Correct unsatisfactory conditions prior to releasing the slab to the owner for installation.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
 - 1. Bring deep depressions up to floor slab level with fill, applied in thicknesses or multiple layers to comply with manufacturer's instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents.
- D. Broom and vacuum clean substrates to be covered upon completion of surface preparation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Installation will proceed only after unsatisfactory conditions have been corrected.

END OF SECTION 096815

SECTION 097200 - WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Vinyl wall covering with custom graphic pattern.

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 on physical characteristics, durability, fade resistance, and fire-test-response characteristics.
- B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement seams and termination points.
- C. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified, full height by **36 inches** wide in size.
 - 1. Wall-Covering Sample: From same production run to be used for the Work.
 - a. Show complete pattern repeat.
- D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Materials: For each type, color, texture, and finish, full height by width equal to 5 percent of amount installed.

1.7 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for installation.
 1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F1141 for appearance shading characteristics.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver digitally printed vinyl wallcovering to the project site in unbroken and undamaged wrappings and clearly labeled with the manufacturer's identification label, quality or grade, UL label and sidemark.
- B. Store materials in a clean, dry storage area with temperature maintained above 55 degrees and relative humidity below 40 percent.
- C. Store material in a flat position to prevent damage to roll ends Do not cross stack material. Support material off the floor in a manner to prevent sagging and warping.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.
- B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

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 WOOD-VENEER WALL COVERING – **WC1**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Koroseal Interior Products, LLC; Arbor Wood Wallcovering. or comparable product by but not limited to one of the following:
 1. SR Wood, Inc.
 2. Wolf-Gordon Inc.
- B. Description: Provide wood-veneer wall covering in rolls from same production run.
 1. Sheet Size: 36 by 120 inches.
 2. Wood Species: As indicated in the Drawings.
 3. Cut and Figure: Quarter cut.
 4. Veneer Match: Book.
 5. Sheet Match: Running.
 6. Applied Backing Material: Manufacturer's standard backing.
 7. Finish: Factory applied using wall-covering manufacturer's three coat urethane finish with 30 percent sheen.
 - a. Colors: As indicated on Drawings.
 8. Fire Rating: Class A per ASTM E84.

2.3 TEXTILE WALL COVERING – **WC2**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Carnegie Fabrics, LLC.; Abacus or a comparable product by, but not limited to one of the following, approved prior to bidding:
 1. Designtex; Design Tex Group Inc. (The).
 2. Knoll, Inc.
 3. Maharam Fabric Corporation; Herman Miller, Inc.
 4. Wolf-Gordon Inc.
- B. Description: Provide wall coverings in rolls from same production run and that comply with the following:
 1. Performance: Type II per CCC-W-408D.
 2. Total Weight: 16 ounces.
 3. Width: 52 inches.
 4. Repeat:
 - a. Length: 27 inches.
 - b. Width: 12 inches.
 5. Applied Backing Material: Manufacturer's proprietary backing that prevents stains and moisture from passing through the textile face, while allowing moisture vapor to escape the wall cavity.
 6. Features:

- a. PVC free.
 - b. Phthalate free.
 - c. Heavy-metals free.
 - d. Halogenated-fire-retardant free.
 - e. Solvents.
 - f. Ozone-depleting chemicals.
7. Colors, Textures, and Patterns: As indicated on Drawings.

2.4 CUSTOM VINYL WALL COVERING – **WC3, WC4, WC5**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Dreamscape; Digital Wallcovering, or comparable product by one of the following:
1. Designtex; Design Tex Group Inc. (The).
 2. Knoll, Inc.
 3. Maharam Fabric Corporation; Herman Miller, Inc.
 4. Wolf-Gordon Inc.
- B. Description: Provide vinyl products in rolls from same production run and complying with the following:
1. Wall Covering Association's W-101M for Type II, Medium Duty
 2. Mildew Resistance: Rating of zero or 1 when tested in accordance with ASTM G21.
 3. Overall Size: As indicated in the Drawings.
 4. Total Weight: 20 ounces, excluding coatings.
 5. Colors, Textures, and Patterns: As indicated in the Drawings.
 6. Fire Rating: Class A per ASTM E84.

2.5 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.
- B. Primer/Sealer: Mildew resistant, and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum moisture content, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.

- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 - 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
 - 2. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
- D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION OF WALL COVERING

- A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.
- B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.
- D. Install wall covering without lifted or curling edges and without visible shrinkage.
- E. Install seams vertical and plumb at least **6 inches** from outside corners and **6 inches** from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.
- F. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.
- G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

- A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 097260 - TACKABLE WALLCOVERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.3 SUMMARY

A. Section Includes:

1. Resilient cork/linoleum tackable wallcovering.
2. Accessories.

B. Related Requirements:

1. Section 064023 "Interior Architectural Woodwork" for display cases requiring tackable wallcoverings.
2. Section 099123 "Interior Painting" for priming for wallcoverings.
3. Section 101100 "Visual Display Units" for marker wall units.

1.4 SUBMITTALS

A. Product data indicating compliance with specified requirements.

B. Installation Instructions.

C. Samples: 7 inch by 9 inch samples of each type of tackable wallcovering material required.

D. Maintenance Instructions: Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.

1.5 QUALITY ASSURANCE

A. Surface Burning Characteristics Classification: Provide materials that meet classification ratings below:

1. ASTM E84 (Flame Spread and Smoke Developed): II/B

B. Single Source Responsibility: Obtain tackable wallcovering system components from a single source.

C. Deliver materials in original factory packaging, labeled with manufacturer, brand name, size, color, and lot number.

- D. Store materials in original, undamaged packaging inside a well-ventilated area protected from weather, moisture, soiling, and extreme temperatures.
- E. Maintain room temperature within the storage area at not less than 68 degrees Fahrenheit during the period materials are stored.
- F. Mock-ups: Prepare mock-ups for architect's review and to establish requirements for seaming and finish trim.
 - 1. Correct areas, modify method of application/installation, or adjust finish texture as directed by architect to comply with specified requirements.
 - 2. Maintain mock-ups accessible to serve as a standard of quality.
 - 3. Install sample panel of each type of wallcovering specified.
 - 4. Install panels in areas designated by architect.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperature within the building at not less than 68 degrees Fahrenheit for a minimum of seventy-two hours prior to beginning of installation.
- B. Do not install tackable wallcovering until the space is enclosed and weatherproof.
- C. Do not install tackable wallcovering until temperature is stabilized and permanent lighting is in place.

1.7 WARRANTY

- A. Submit manufacturer's limited five-year written warranty against manufacturing defects.

PART 2 - PRODUCTS

2.1 PRODUCTS -**TCK1, TCK2**

- A. Basis of Design Product: Subject to compliance with requirements, provide Walltalkers, Tac-Wall, or comparable product.

2.2 MATERIALS

- A. Uni-color resilient homogeneous tackable linoleum surface consisting of linseed oil, granulated cork, rosin binders, and dry pigments calendered onto natural burlap backing. Color shall extend through thickness of material.
 - 1. Roll Width: 48 inches.
 - 2. Thickness: 1/4 inch.
 - 3. Color: As indicated in Drawings.

2.3 ACCESSORIES

- A. Adhesive: Solvent-free, SBR type linoleum adhesive (L-910) or polyvinyl acetate dispersion type (contact adhesive) when used in a press.
- B. Trim for Tackable Wall:
 - 1. Manufacturer's standard 'J' trim.
 - a. Finish: Clear satin, anodized aluminum
 - b. Size: 1/4 inch.
- C. Push-Pins: 48 push pins per room, translucent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions in which tackable wallcoverings will be installed.
- B. Complete finishing operations, including painting, before beginning installation of tackable wallcovering materials.
- C. Wall surfaces to receive wallcovering materials shall be dry and free from dirt, grease, loose paint, and scale.
- D. Notify the contractor and architect in writing of any conditions detrimental to the proper and timely completion of the installation.
- E. Beginning of installation means acceptance of surface conditions.

3.2 PREPARATION

- A. Surface Preparation: Remove hardware, accessories, plates, and similar items to allow tackable wallcovering to be installed.
- B. Gypsum board surface: Recess nails and screws. Repair irregular tape joints, sand and remove dust.
- C. Painted surface: Remove loose paint or scale. Sand surface of enamel or gloss paint and wipe clean with damp cloth.
- D. Ensure wall surfaces scheduled to receive tackable wallcovering are properly sealed with a quality primer specified for use under flexible vinyl wallcoverings.

3.3 APPLICATION

- A. Comply with manufacturer's printed installation instructions.

- B. Cut sheets to size including a few inches of overage. Allow sheets to lay flat for at least twenty-four hours prior to the application. Mark roll direction and sequence on the backside of each sheet. Hang sheets in sequence as cut from the roll, do not reverse sheets.
- C. Permanent HVAC system should be set to 68 degrees Fahrenheit for at least seventy-two hours prior to, during, and after the installation.
- D. Back roll each sheet prior to the installation to release curl memory.
- E. For seamed applications, using a seam and strip cutter remove the factory edge of one sheet. Using the same tool, overlap and trace cut the mating edge of the second sheet. Repeat this step for as many sheets as required for the job.
- F. Scribe, cut, and fit material to butt tightly to adjacent surfaces, built-in casework, and permanent fixtures and pipes.
- G. Apply adhesive with a 1/16 inch square notch trowel to the area to receiving the sheet (apply enough for one sheet at a time).
- H. Work from top to bottom then side to side. Roll sheet firmly into adhesive for positive contact and to remove air bubbles.
- I. Remove adhesive residue immediately after each panel is hung with a mild soap/water solution and a soft cloth/sponge.

3.4 CLEANING

- A. Clean wallcovering using a sponge with a neutral pH cleaning solution. Do not use abrasive cleaners. Rinse thoroughly with water and let dry before using.
- B. Remove adhesive while wet.

3.5 PROTECTION

- A. Protect installed product and finish surfaces from damage during construction.

END OF SECTION 097260

SECTION 098436 - SOUND-ABSORBING CEILING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
 - 1. Sound-absorbing baffle panels.
 - 2. Sound-absorbing cloud panels.

1.3 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include panel edge, core material, and mounting indicated.
- B. Shop Drawings: For unit assembly and installation.
 - 1. Include reflected ceiling plans, elevations, sections, and mounting devices and details.
 - 2. Include details at joints and corners, and details at ceiling intersections and intersections with walls.
- C. Samples for Verification: For the following products:
 - 1. Mounting Devices: Full-size Samples.
 - 2. Assembled Panels: Approximately 36 by 36 inches, including joints and mounting methods.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Electrical outlets.
 - 2. Suspended ceiling components above ceiling units.
 - 3. Structural members to which suspension devices will be attached.
 - 4. Items penetrating or covered by units including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Alarms.
 - e. Sprinklers.
 - f. Access panels.
 - 5. Show operation of hinged and sliding components covered by or adjacent to units.
- B. Sample Warranty: For manufacturer's special warranty.
- C. Living Building Challenge Criteria: LBC Compliant. Red List Free.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturer's written cleaning and stain-removal instructions.

1.8 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. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices.
 - 2. Acoustical Baffle Panels: Full-size units, 2 minimum of each panel size indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Acoustical performance.
 - 2. Warranty Period: Four years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain ceiling units specified in this Section from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 75 or less.
 - b. Smoke-Developed Index: 450 or less.

2.3 SOUND-ABSORBING CEILING UNITS

- A. Manufacturers
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Fräsch! products indicated, or comparable products by one of the following:
 - a. Acoustical Panel Systems (APS, Inc.).
 - b. Arktura.
 - c. Armstrong World Industries.
 - d. Cardinal Acoustics, Inc.

e. J2.

B. Sound-Absorbing Cloud Panels – **ACC1 to ACC6**

1. Basis of Design Product: CLOUD.
2. Color: As indicated in the Finish Schedule Legend
3. Material: 100 percent PET.
4. Panel Thickness: 9 mm.
5. Panel Shape and Size: As indicated in the Finish Schedule Legend.
6. Mounting: Top-edge mounted with manufacturer's standard cable suspension system secured to substrate.

C. Sound-Absorbing Cloud Panels – **ACC7 to ACC8**

1. Basis of Design Product: BAFL KIT.
2. Color: As indicated in the Finish Schedule Legend
3. Material: 9 mm, 100 percent PET.
4. Baffle Width: 2-3/4 inches nominal.
5. Baffle Shape and Size: 10 inches high by 84 inches long rectangular baffles, with seven baffles per kit. Configuration and custom lengths, if any, as indicated in Drawings.
6. Mounting: Manufacturer's Acoustic Baffle Kit with aircraft cable suspension system secured to substrate.

D. Sound-Absorbing Baffle Panels – **ACB1**

1. Basis-of-Design Product: SKINNY BAFFLE
2. Color: As indicated in the Finish Schedule Legend.
3. Material: 9 mm, 100 percent PET panel.
4. Baffle Width: 1 inch.
5. Baffle Size: 12 inches high by lengths as indicated on Drawings.
6. Shape: Straight.
7. Configurations: As indicated on Drawings.
8. Mounting: Top-edge mounted with manufacturer's aircraft cable/Unistrut suspension system secured to substrate.

2.4 ACOUSTIC MATERIAL

A. PET Felt Material: 100 percent Polyethylene Terephthalate with 55 percent recycled content, utilized in sound insulation and sound absorption applications.

1. Sizes: Custom up to 48 by 96 inches.
2. Thicknesses: 9 mm, 12 mm and custom up to 24 mm.
3. Sound Absorption: 0.75 NRC per ASTM C423.

2.5 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated, with rigid, monolithic material to reinforce panels against warpage and damage.

B. Measure each area and establish layout of panels and joints of uniform size indicated on Drawings.

- C. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
 - 1. Thickness.
 - 2. Edge straightness.
 - 3. Overall length and width.
 - 4. Squareness from corner to corner.
 - 5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

- A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch in 48 inches, noncumulative.
- B. Variation from Level or Slope: Plus or minus 1/8 inch.
- C. Variation of Joint Width: Not more than 1/16 inch wide from reveal line in 48 inches, noncumulative.

3.4 CLEANING

- A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098436

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel and iron.
 - 2. Galvanized metal.
 - 3. Paint and rust removal at existing steel structure.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. 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. 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.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints 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 MANUFACTURERS

- 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. Benjamin Moore & Co.

2. Glidden Professional.
3. PPG Architectural Coatings.
4. Sherwin-Williams Company (The).

- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range.

2.3 REPAINTING, GENERAL

2.4 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- 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. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 11.
 - 2. SSPC-SP 6/NACE No. 3 at existing exterior steel columns.
 - a. Clean to bright metal.
 - b. Wipe off residue with mineral spirits and either steel wool or soft rags.
 - c. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
 - d. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.
- 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 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 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 painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. 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 to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.

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.
- 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, including Galvanized Steel:

- 1. Water-Based Coating System for doors, frames and miscellaneous metals:
 - a. Prime Coat: Primer, rust inhibitive, water based.
 - 1) S-W Pro Industrial Pro-Cryl Universal Metal Primer, B66-310 Series, <100 g/L VOC.
 - b. Intermediate Coat: Exterior, water based, matching topcoat.
 - c. Topcoat: Alkyd urethane, water based.
 - 1) S-W Pro Industrial Water Based Alkyd Urethane Semi-Gloss, B53-1150 Series, <50g/L VOC.
- 2. High Performance Epoxy/Polyurethane Hybrid Coating System for canopies, structural steel.
 - a. Prime Coat: Shop-applied, rust inhibitive.
 - 1) S-W Steel Spec Universal Primer, B50 series, <340 g/L.
 - b. Intermediate Coat: Epoxy, high build.
 - 1) S-W Macropoxy 646-100 Fast Cure Epoxy, B58-600 Series, <100g/L VOC.
 - c. Topcoat: Polyurethane, high solids, semi-gloss.
 - 1) S-W Hi-Solids Polyurethane 250, B65 Series, <250 g/L VOC.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:

- 1. Steel and iron.
- 2. Gypsum board.

- B. Related Requirements:

- 1. Low VOC coatings complying with Utah Administrative Code R307-361 are required as part of the work of this Section.
- 2. Section 051200 "Structural Steel Framing" for shop priming structural steel.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

- 1. Indicate VOC content.

- B. Samples for Initial Selection: For each type of topcoat product.

- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

- 1. Submit Samples on rigid backing, 8 inches square.
- 2. Label each coat of each Sample.
- 3. Label each Sample for location and application area.

- D. Product List: For each product indicated, include the following:

- 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
- 2. Include VOC content.

1.4 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
1. Provide summary in Excel spreadsheet, of location, manufacturer, product, sheen, and tinting mix.

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. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:
1. Product name and type (description).
 2. Batch date.
 3. Color number.
 4. VOC content.

5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Benjamin Moore & Co.
2. Glidden Professional.
3. PPG Architectural Coatings.
4. Pratt & Lambert.
5. Sherwin-Williams Company (The).

B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:

1. Products are approved by manufacturer in writing for application specified.
2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.

C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.

1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. VOC Content: Utah Administrative Code R307-361 Products shall comply with VOC limits of authorities having jurisdiction and, for interior and exterior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 100 g/L.
 3. Dry-Fog Coatings: 150 g/L.
 4. Primers, Sealers, and Undercoaters: 100 g/L.
 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 7. Pretreatment Wash Primers: 420 g/L.
 8. Floor Coating Foot Traffic: 100 g/L.
 9. Floor Coatings High Performance: 250 g/L.
- C. Colors: As indicated in a color schedule.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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.
1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Gypsum Board: 12 percent.
 2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- 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. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal".
- 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 fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Tanks that do not have factory-applied final finishes.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - f. Other items as directed by Architect.
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 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.

- 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. Metal Substrates (Aluminum, Steel, Galvanized Steel):

- 1. Water-Based Dry-Fall System, Flat Finish:
 - a. Prime Coat: Primer, rust-inhibitive, water based.
 - 1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils wet, 1.9 to 3.8 mils dry, <100 g/L VOC.
 - b. Top Coat: Dry-fall, acrylic, flat:
 - 1) S-W Pro Industrial Waterborne Acrylic DryFall Flat, B42W81, at 5.8 mils (0.147 mm) wet, 2.3 mils (0.058 mm) dry, <50g/L VOC.
- 2. Waterbased Alkyd Urethane System:
 - a. Prime Coat:
 - 1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils (0.127 to 0.254 mm) wet, 2.0 to 4.0 mils (0.051 to 0.102 mm) dry, <100 g/L.
 - b. Intermediate Coat: Water-based acrylic-alkyd, interior, matching topcoat.
 - c. Topcoat: Water-based alkyd-urethane, semi-gloss, interior:
 - 1) S-W Pro Industrial Waterbased Alkyd Urethane Semi-Gloss, B53-1150 Series, at 4.0 mils (0.102 mm) wet, 1.4 mils (0.036 mm) dry, per coat.

B. Gypsum Board Substrates:

- 1. Latex System, Semi-Gloss Finish:
 - a. Prime Coat: Primer, latex, interior:
 - 1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils (0.102 mm) wet, 1.0 mils (0.025 mm) dry, 0g/L VOC.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss:
 - 1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils (0.102 mm) wet, 1.6 mils (0.041 mm) dry, per coat, 0 g/L VOC.
- 2. Water-Based Light Industrial / Epoxy Coating System, Semi-Gloss Finish:
 - a. Prime Coat: Primer sealer, latex, interior:
 - 1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils (0.102 mm) wet, 1.0 mils (0.025 mm) dry.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based, semi-gloss:
 - 1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.

END OF SECTION 099123

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Visual display board assemblies.

- B. Related Sections:

- 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing paneling that is concealed within other construction before paneling installation.
- 2. Section 097260 "Tackable Wallcovering" for resilient cork/linoleum tackable wallcovering.
- 3. Section 099123 "Interior Painting" for priming gypsum board to receive visual display units.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

- B. Shop Drawings: For visual display units.

- 1. Include plans, elevations, sections, details, and attachment to other work.
- 2. Show locations of panel joints.
- 3. Include sections of typical trim members.

- C. Samples for Initial Selection: For each type of visual display unit indicated.

- 1. Samples of facings for each visual display panel type, indicating color and texture.
- 2. Accessories: Samples to verify color selected.

- D. Samples for Verification: For each type of visual display unit indicated.

- 1. Visual Display Panel: Not less than 8-1/2 by 11 inches, with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
- 2. Trim: 6-inch- long sections of each trim profile.
- 3. Display Rail: 6-inch long section of each type.
- 4. Accessories: Full-size Sample of each type of accessory.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each visual display unit, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For visual display units to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of visual display surfaces from single source from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.9 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces exhibit crazing, cracking, or flaking.
 - 2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 450 or less.

2.2 VISUAL DISPLAY BOARD ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. ADP Lemco.
 2. ASI Visual Display Products; ASI Group.
 3. Claridge Products and Equipment, Inc.
 4. Moore Co.
 5. Platinum Visual Systems.
- B. Visual Display Board Assembly:
1. Markerboards:
 - a. Magnetic porcelain-enamel facing on core indicated; fabricated for dimensional framed panel assemblies.
 - b. Corners: Square.
 - c. Color: Gloss White.
 - d. Width: As indicated in Drawings.
 - e. Height: As indicated in Drawings.
 - f. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect as indicated on approved Shop Drawings.
 - g. Joint Accessories: Manufacturer's standard, concealed aluminum or steel spline at butt joints.
 - h. Panels and Accessories:
 - 1) Accessories:
 - a) 12 inch long magnetic tray and one set of four manufacturer approved markers – black, blue, green, and red.
 - i. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum; standard size and shape unless indicated otherwise on Drawings.
 - 1) Provide manufacturer's standard "J" shape edge trim with clear, satin, anodized aluminum finish at horizontal and vertical exposed panel edges, and "H" shape edge trim with baked enamel or powder coated painted finish matching panel faces at vertical edges of adjoining panels.
 - j. Mounting Method: As recommended in writing by manufacturer.

- k. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, designed to hold accessories.
 - 1) Size: 2 inches high by full length of visual display unit.
 - 2) Location: As indicated on Drawings.
 - 3) Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of display rail or fraction thereof.
 - 4) Flag Holder: One for each room.
 - 5) Tackboard Insert Color: As selected by Architect from manufacturer's full range.
 - 6) Aluminum Color: Match finish of visual display assembly trim.

C. Aluminum Frames: Fabricated from not less than 0.062-inch- thick, extruded aluminum; of size and shape indicated on Drawings.

- 1. Aluminum Finish: Clear anodic Color anodic Manufacturer's standard baked-enamel or powder-coat finish.

2.3 MARKERBOARD PANELS

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of galvanized sheet backing, core material, and porcelain-enamel face sheet with low-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.

- 1. Face Sheet Thickness: 0.0149 inch uncoated base metal thickness.
- 2. MDF Core: 7/16 inch thick; with galvanized steel sheet baking matching uncoated face panel thickness.
- 3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.4 MATERIALS

- A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.
- B. MDF: ANSI A208.2, Grade 130.
- C. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish; with surface-burning characteristics indicated.
- D. Extruded Aluminum: ASTM B 221, Alloy 6063.
- E. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 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 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.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display units.
- C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

3.3 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
 - C. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.
 - D. Visual Display Board Assembly Mounting Heights:
 1. As indicated on Drawings.
- 3.4 CLEANING AND PROTECTION
- A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
 - B. Touch up factory-applied finishes to restore damaged or soiled areas.
 - C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 101416 - PLAQUES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal plaques.

1.2 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For plaques.

1. Include fabrication and installation details and attachments to other work.
2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each plaque at least half size .

- C. Samples for Verification: For each type of plaque showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Plaques: Half-size Sample.
2. Exposed Accessories: Full-size Sample of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.

- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For plaques to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 METAL PLAQUES

- A. Cast Plaque: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A.R.K. Ramos.
 - b. ACE Sign Systems, Inc.
 - c. Gemini Incorporated.
 - d. Metal Arts.
 - e. Southwell Company (The).
 - 2. Plaque Material: Cast aluminum.
 - 3. Plaque Thickness: 0.25 inch.
 - 4. Finishes:
 - a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
 - 5. Background Texture: Pebble.
 - 6. Integrally Cast Border Style: Raised flat band.
 - 7. Mounting: Concealed studs.
 - 8. Text and Typeface: Typeface as selected by Architect from manufacturer's full range.
 - 9. Copy: Include School Board with Superintendent's name showing the District leadership, the name of the Contractor, the name of the Architect, the dedication and any other copy that may be indicated in the Drawings, or requested by the District.
 - a. Sized as required to fit the above, but not less than 32 inches wide by 16 inches high.

2.3 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by plaque manufacturer for casting process used and for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
- B. Adhesive: As recommended by plaque manufacturer.
 - 1. Verify adhesives have a VOC content of 200 g/L or less.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 FABRICATION

- A. General: Provide manufacturer's standard plaques according to requirements indicated.
 - 1. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 - 2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 3. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
 - 4. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Surface-Engraved Graphics: Machine-engrave characters and other graphic devices into indicated plaque surface to produce precisely formed copy, incised to uniform depth.
 - 1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- 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.
- C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

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.
- B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL PLAQUES

- A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
 - 2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
 - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 - 2. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as plaques are installed.
- C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101416

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Dimensional characters.
 - a. Cast dimensional characters.

1.2 COORDINATION

- A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
- C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Dimensional Characters: Full-size Sample of each type of dimensional character.
 - 2. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

- A. Cast Characters for Exterior Building Signage: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
 - 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. ACE Sign Systems, Inc.
 - b. ASI Sign Systems, Inc.
 - c. Gemini Incorporated.
 - d. Metal Arts.
 - 2. Character Material: Cast aluminum.
 - 3. Character Height: 24 inches.
 - 4. Thickness: As recommended by the manufacturer for the character height, but not less than 1 inch.
 - 5. Integral Aluminum Finish: Clear anodized.
 - 6. Mounting: Bottom rail system.
 - 7. Typeface: Helvetica.
 - 8. Message: Refer to exterior elevations in the Drawings; confirm with Owner and include in submittals.
- B. Cutout Characters for Interior Applications: Characters with uniform faces; square-cut, smooth, eased edges; precisely formed lines and profiles; and as follows:

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:
 - e. ACE Sign Systems, Inc.
 - f. ASI Sign Systems, Inc.
 - g. Gemini Incorporated.
 - h. Metal Arts.
2. Character Material: Sheet or plate aluminum.
 - a. Character Height: As indicated on Drawings.
 - b. Thickness: 0.25 inch.
 - c. Finishes:
 - 1) Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
 - 2) Overcoat: Manufacturer's standard baked-on clear coating.
 - d. Mounting: Concealed studs.
 - e. Typeface: As indicated on Drawings.
 - f. Message: Refer to interior elevations in Drawings; confirm with Owner and include in submittals.

2.2 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- B. Aluminum Sheet and Plate: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 1. Use concealed fasteners and anchors unless indicated to be exposed.

2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners.
 2. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 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.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DIMENSIONAL CHARACTERS

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

- a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
- b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

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. Panel signs.
 - 2. Factory engraved character signs.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available type styles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Panel Signs: Full-size sample for each form, finish and color.
 - 2. Factory Engraved Character Signs; Full-size sample of characters on glass.
 - 3. Variable Component Materials: Full-size sample of each base material, character (letter, number, and graphic element) in each exposed color and finish.
 - 4. Full-size Samples, if approved, will be returned to Contractor for use in Project.
- E. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- C. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

1.8 COORDINATION

- A. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 PANEL SIGNS

- A. Available Manufacturers Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. ABC Architectural Signing System.
 2. Allenite.
 3. Andco Industries Corp.
 4. APCO Graphics, Inc.
 5. ASI Sign Systems, Inc.
 6. Diskey Sign Corp.
 7. Modulex.
 8. Mohawk Sign Systems.
 9. Spanjer Brothers, Inc.
 10. Vomar Products, Inc.
- B. Interior Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.
- C. Panel Sign Types:
1. Type 1, Type 3 and Type 5: Cast aluminum face plate with fixed message.
 2. Type 2: Cast aluminum face plate with fixed message; with additional changeable message area of acrylic sheet with changeable inserts.
 3. Type 4: Cast acrylic sheet with factory-engraved lettering.
- D. Fixed Message – Sign Types 1, 2, 3 and 5 (ADA Compliant Signage with Raised Copy and Braille): Form characters from brushed aluminum finished sheet forming the sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks.
1. Panel Material: Brushed aluminum.
 2. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.
 3. Color: As indicated in Drawings.
 4. Raised Copy Finish/Color: As indicated in Drawings.
- E. Changeable Message – Sign Type 2 only:
1. Face Sheet: Acrylic Sheet: 0.080 inch (2.03 mm).
 - a. Color: To be selected by Architect from manufacturer's full range.
 2. Changeable Message Inserts: Fabricate signs as scheduled to allow insertion of changeable messages in the form of changeable panel inserts for use in fixed frames.
- F. Cast Acrylic Sheet – Sign Type 4:
1. Material: Cast-acrylic sheet.
 2. Copy: Factory engraved characters.
 3. Character Style: As indicated in Drawings.
 4. Text: Appropriate to the space.
 5. Character and Panel Sizes: As indicated in Drawings.
 6. Colors: As indicated in Drawings.

- G. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit sign panel construction and mounting conditions indicated. Affix concealed anchors to be set into epoxy anchors in partition to which sign is mounted. Finished assembly must resist 125 lb. pullout.
- H. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

2.3 SIGN MATERIALS

- A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Aluminum Castings: ASTM B26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - a. Use vandal-proof fasteners.
- B. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use epoxy anchors for placement in pre-drilled holes for corridor signage. Furnish inserts, as required, to be set into concrete or masonry work.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Furnish two blank inserts for each sign for Owner's use.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 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.

2.7 FINISHES

- A. Aluminum Finishes: Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
 1. Class II Clear Anodized Fine Satin Finish: AA-M31C21A31 (Mechanical Finish: Fine satin directional textured; Chemical Finish: Fine matte etched finish; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).
- B. Acrylic Sheet Finishes:
 1. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.
- C. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.
- D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- E. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items, including anchor inserts, are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls and according to the accessibility standard .
- C. Mounting Methods: Attach panel signs to substrates using the methods indicated below:
 - 1. Bracket-Mounted Units: Provide brackets, fittings, and hardware as appropriate for mounting signs flush to wall. Attach brackets and fittings securely to walls or ceilings with concealed fasteners and anchoring devices to comply with manufacturer's directions to prevent unauthorized removal. Attach face plate to brackets in a manner to resist leverage and pry-bar vandalism. Provide anchorage to provide resistance to 125 ft/lb.
 - 2. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
 - 3. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign and two-face tape.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423.16

SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

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. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

- B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for supports that attach floor-and-ceiling-anchored compartments and post-to-ceiling screens to overhead structural system.
 - 2. Section 061000 "Rough Carpentry" for blocking .
 - 3. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

- B. Shop Drawings: For toilet compartments.

- 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of centerlines of toilet fixtures.
 - 3. Show locations of floor drains.
 - 4. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.

- C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

- 1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
 - 2. Each type of hardware and accessory.

- D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of toilet compartment.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Door Hinges: Two hinge(s) with associated fasteners.
 - 2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
 - 3. Door Bumper: One door bumper(s) with associated fasteners.
 - 4. Door Pull: One door pull(s) with associated fasteners.
 - 5. Fasteners: Ten fasteners of each size and type.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET 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. ASI Accurate Partitions; ASI Group.
 - 2. Bobrick Washroom Equipment, Inc.
 - 3. Bradley Corporation.
 - 4. General Partitions Mfg. Corp.
 - 5. Metpar Corp.

- B. Toilet-Enclosure Style: Floor and ceiling anchored.
- C. Urinal-Screen Style: Post to ceiling.
- D. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 1-inch- thick doors and pilasters and minimum thick panels.
- E. Pilaster Shoes and Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- F. Urinal-Screen Post: Manufacturer's standard post design of 1-3/4-inch- square, aluminum tube with satin finish ; with shoe and sleeve (cap) matching that on the pilaster.
- G. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel .
- H. Phenolic-Panel Finish:
 - 1. Facing Sheet Finish: One color and pattern in each room.
 - 2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.
 - 3. Edge Color: Through-color matching facing sheet color.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty 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 compartments 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 out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 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.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide out-swinging doors with a minimum 32-inch- wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 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: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Full-Height (Continuous) Brackets: Secure panels 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. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION 102113.17

SECTION 102239 - FOLDING PANEL PARTITIONS

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. Manually operated, paired panel partitions.
- 2. Electrically operated, continuously hinged partitions.

- B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
- 2. Electrical and communications Sections for electrical service and connections for motor operators, controls, and limit switches and for system disconnect switches.

1.3 DEFINITIONS

- A. STC: Sound Transmission Class.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For operable panel partitions.

- 1. Include plans, elevations, sections, attachment details, and numbered panel installation sequence.
- 2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
- 3. Include diagrams for power, signal, and control wiring.

- C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

- 1. Include Samples of accessories involving color selection.

- D. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:
 - 1. Textile Facing Material: Full width by not less than 36-inch- long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
 - 2. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches square.
 - 3. Panel Edge Material: Not less than 3 inches long.
 - 4. Hardware: One of each exposed door-operating device.

- E. Delegated-Design Submittal: For operable panel partitions.
 - 1. Include design calculations for seismic restraints that brace tracks to structure above.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Partition track, track supports and bracing, switches, turning space, and storage layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which suspension systems will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. HVAC ductwork, outlets, and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Smoke detectors.
 - f. Access panels.

- B. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

- C. Qualification Data: For Installer.

- D. Seismic Qualification Certificates: For operable panel partitions, tracks, accessories, and components, from manufacturer. Include seismic capacity of partition assemblies to remain in vertical position during a seismic event and the following:
 - 1. Basis for Certification: Indicate whether certification is based on analysis, testing, or experience data, according to ASCE/SEI 7.
 - 2. Detailed description of partition anchorage devices on which the certification is based and their installation requirements.

- E. Product Certificates: For each type of operable panel partition.
 - 1. Include approval letter signed by manufacturer acknowledging Owner-furnished panel facing material complies with requirements.

- F. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.

- G. Field quality-control reports.
- H. Sample Warranty: For manufacturer's special warranty.

1.7 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.
 - c. Electric operator and controls.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.10 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.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period:

- a. Partition Warranty: Three years from date of Substantial Completion.
- b. Suspension Warranty:
 - 1) Electrically Operated Panels: Two years from date of Substantial Completion.
 - 2) Manually Operated Panels: Five years from date of Substantial Completion.
- c. Hinges: Lifetime.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic bracing of tracks to structure above.
- B. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the partition panels will remain in place without separation of any parts when subjected to the seismic forces specified."
- C. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.
- D. 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. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 OPERABLE ACOUSTICAL PANELS

- A. Operable Acoustical Panels: 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 Encore or a comparable product by one of the following:
 - a. Moderco Inc.

- b. Panelfold Inc.
- B. Panel Operation:
 - 1. Electrically operated, continuously hinged panels, top supported with operable floor seals and automatic top seals.
 - 2. Manually operated, paired panels, top supported panels with operable floor seals and automatic top seals.
- 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: Equal widths.
- E. STC: Not less than 52.
- F. Panel Weight: 8.2 lb/sq. ft. maximum.
- G. Panel Thickness: Nominal dimension of 4-1/4 inches.
- H. Panel Materials:
 - 1. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
 - 2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard nominal thickness for uncoated steel.
 - a. Panel skins shall be lock formed and welded to frame for unitized construction.
- I. Panel Closure: Manufacturer's standard unless otherwise indicated.
 - 1. Final Closure:
 - a. Electrically Operated Panels: Electrically expanding jamb seal. Manual or side seal closures are not permitted. Floor track not permitted.
 - b. Manually Operated Panels: Horizontally expanding panel edge with removable crank.
- J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
 - 1. Hinges: Full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates within panel.
 - 2. Hinges mounted into panel edge or vertical astragal are not acceptable.

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 aluminum astragals with tongue and groove configuration mounted on each edge of panel, with continuous, resilient acoustical seal.
1. Rigid plastic astragals are not acceptable.
- C. Horizontal Top Seals: Automatic operable top seals. Manually operated top seals are not permitted.
1. Basis of Design Product: Modernfold; SureSet.
- D. Horizontal Bottom Seals:
1. Basis of Design Product: Modernfold; SureSet bottom seal.
 2. Automatic Bottom Seals: Seals drop automatically as panels are positioned and final closure is made, without need for tools or cranks.
 - a. Operating Clearance: 2 inches, plus 1/2 inch to minus 1-1/2 inch.
 3. Manual Bottom Seals: Manually activated from panel edge or face.
 - a. Operating Clearance: 2 inches, plus 1/2 inch to minus 1-1/2 inch.
 - b. Extended Seal Downward Force: 120 pounds to the floor throughout operating range.

2.4 PANEL FINISH FACINGS

- A. Description: Finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with invisible seams complying with Shop Drawings for location, 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. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.
- C. Markerboard: White enamel on steel, bonded to the panel face with horizontal trim and concealed fasteners. Provide uninterrupted work surface, with trim at vertical edges.
1. Trim Color: As selected by Architect from Manufacturer's full range of colors.

2.5 SUSPENSION SYSTEMS

- A. Steel Tracks: Steel 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. Exposed Track Soffit: Integral to track.
 - a. Finish: White, powder coat.
 2. Basis of Design Product: Modernfold; No. 17 Suspension System.
 3. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
 - a. One steel trolley per panel.
 - b. Non-steel wheel are not acceptable.
- A. Aluminum Tracks: Structural aluminum, 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. Exposed Track Soffit: Integral to track, with configuration of the assembly design to accommodate termination of the plenum sound barrier on each side of the track.
 - a. Finish: White, powder coat.
 2. Aluminum Track Basis of Design Product: Modernfold: No. 30 Suspension System.
 3. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
 - a. One trolley in alternating panels.
 - b. Wheels: 3-inch diameter glass reinforced nylon with steel precision ground ball-bearing wheels.
 - c. Steel wheels or reinforced polymer trolleys on aluminum track are not permitted.
 - d. Attachment to Panels: Pendant bolt welded to steel mounting plate.
- B. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum to match the track.
- C. Aluminum Finish: 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 ELECTRIC OPERATORS

- A. Factory-assembled electric operation system of size and capacity recommended and provided by operable panel partition manufacturer for partition specified; with electric motor and factory-prewired motor controls, speed reducer, chain drive, control stations, control devices, and accessories required for operation. Include wiring from control stations to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Provide a positive drive chain attached to the lead panel. Cable, belt or other friction devices are not acceptable.
- B. Comply with NFPA 70.
- C. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
- D. Motor Electrical Characteristics:
 1. Horsepower: Manufacturer's standard.
 2. Volts: 208.
 3. Phase: Polyphase.
 4. Hertz: 60.
- E. Control Stations: Two single-key-operated, constant-pressure control stations located remotely from each other on opposite sides and opposite ends of partition run. Wire in series to require simultaneous activation of both key stations to operate partition. Each three-position control station labeled "Open," "Close," and " Stop." Furnish two keys per station.
- F. Obstruction-Detection Devices: Equip each motorized operable panel partition with indicated automatic safety sensor that causes operator to immediately stop and reverse direction.
 1. Sensor Edge: Wireless, Contact-pressure-sensitive safety edge along partition's leading edge.
 2. Basis of Design Product: Presto Safety Noe.
- G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop operable panel partition at fully extended and fully stacked positions.
- H. Emergency Release Mechanism: Quick disconnect-release of electric-motor drive system, permitting manual operation in event of operating failure.
- I. Electric Interlock: Equip each motorized operable panel partition with electric interlocks at locations indicated, to prevent operation of operable panel partition under the following conditions:
 1. On storage pocket door, to prevent operation if door is not in fully open position.

2.7 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. Hinges in finish to match other exposed hardware.
 1. Manufacturer's standard method to secure storage pocket door in closed position.
 2. Basis of Design Product: Modernfold; Acousti-Seal Pocket Door.

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

- 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 FIELD QUALITY CONTROL

- A. An operable panel partition installation will be considered defective if it does not pass tests and inspections.
- B. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust pass doors and storage pocket doors to operate smoothly and easily, without binding or warping.
- C. Verify that safety devices are properly functioning.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

3.6 PARTITION SCHEDULE

- A. Electrically Operated Partitions:
 - 1. Door No. B119-G.
 - a. Finish: Markerboard, both sides; full height of panel.
 - b. Bottom Seal: Automatic.
 - c. Suspension System: Aluminum.
 - 2. Door No. B119-H.
 - a. Finish: Markerboard, both sides; full height of panel.
 - b. Bottom Seal: Automatic.
 - c. Suspension System: Aluminum.

- B. Manually Operated Partitions:
 - 1. Door No. B119-D.
 - a. Finish: Markerboard on both sides; full height of panel.
 - b. Bottom Seal: Manual.
 - c. Suspension System: Steel.
 - 2. Door No. B123-C.
 - a. Finish: Markerboard, both sides; full height of panel.
 - b. Bottom Seal: Manual.
 - c. Suspension System: Steel.

END OF SECTION 102239

SECTION 102241 - AUTOMATIC VERTICALLY RETRACTABLE ACOUSTIC WALL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electrically operated, vertically retractable acoustic walls.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for supports that attach vertically retractable walls to overhead structural system.
2. Section 092900 "Gypsum Board" for sound barrier and pocket construction above the ceiling.
3. Division 26 Electrical sections for wiring and connections to main power, including disconnect switches at each motor location.

1.2 DEFINITIONS

- A. STC: Sound Transmission Class.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For retractable walls.

1. Include plans, elevations, sections, attachment details.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware, wall guides and blocking.
3. Include diagrams for power, signal, and control wiring.

- C. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:

1. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches square.
2. Seals and Guides: Not less than 3 inches long.
3. Hardware: One of each exposed door-operating device.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Retractable wall guides, supports and bracing, switches, and storage layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which suspension systems will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. HVAC ductwork, outlets, and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Smoke detectors.
 - f. Access panels.
 - 6. Plenum acoustical barriers.
- B. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.
- C. Seismic Qualification Certificates: For retractable walls, accessories, and components, from manufacturer. Include seismic capacity of retractable wall assemblies to remain in vertical position during a seismic event and the following:
 - 1. Basis for Certification: Indicate whether certification is based on analysis, testing, or experience data, according to ASCE/SEI 7.
 - 2. Detailed description of retractable wall anchorage devices on which the certification is based and their installation requirements.
- D. Product Test Reports: For each vertically retractable wall, for tests performed by a qualified testing agency.
- E. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For vertically retractable walls 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, guides, and other operating components.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 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.

1.9 MAINTENANCE MATERIALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of retractable walls that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of retractable walls.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Retractable walls are to withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Acoustical Performance: Provide retractable walls tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound-Transmission Requirements: Retractable wall assembly tested for laboratory sound-transmission loss performance according to ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.
- C. 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.

2.2 VERTICALLY RETRACTABLE ACOUSTIC WALL

- A. Retractable Acoustic Wall: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Skyfold Inc. Baie d'Urfe; Zenith Automatic Vertically Retractable Acoustic Wall or comparable product approved prior to bidding.
- B. Panel Operation: Motor operated, vertically retractable acoustic wall.
 1. Switches: Two push button switches, wired in series with power controlled by a single three position keyed switch, requiring the keyed switch to be turned on to the designated direction, then simultaneously pressing the push button switches to move the retractable wall. Removing pressure will immediately stop the retractable wall.
 2. Switch Location: On opposite sides of the acoustic wall at opposite ends of the acoustic wall, requiring two-person operation with each having a clear view of opposite sides of the acoustic wall.
 3. Motor Assembly: Located directly above the center line of the retractable wall. Type of drive system as required by the size of the wall.
 4. Operation Cycles: Wall components and operators capable of operating for not less than 10,000. One operation cycle is complete when a retractable wall is opened from the closed position to the fully open position and returned to the closed position.
 - a. Wear Surfaces: Designed to operate quietly with minimum wear.
- C. Electrical Characteristics:
 1. Power: 208 VAC, 3 phase.
 2. Control Box: NEMA 1.
 3. Low Voltage Wiring: By Division 26, 18 gauge from switches to control box.
 4. Switches:
 - a. Two push button switches, wired in series, with power controlled by one three-position keyed switch.
 - b. Equip one switch with an LED that flashes fault codes in case of failure with the electrical system.
- D. Safety Equipment:
 1. Primary Brake: Electromagnetic, to stop the retractable wall when power is lost to the system.
 - a. Minimum Retarding Torque: Rating equal to 200 percent of the power drive full load torque.
 - b. Provide manual override and brake release lever.
 2. Backup Brake: Dynamic brake to lower retractable wall at a controlled speed of no more than 150 percent of the normal down speed, in case of catastrophic failure in the power train.
 3. Limit Switches: Set to stop retractable wall at the up and down travel limits.
 4. Over Torque Detector: Mechanical detector to sense a jam in the system and to limit over travel in the up direction in case of primary limit switch failure.
 5. Provide overload protection.
 6. Obstruction Detection: Pressure sensitive bottom edge.
- E. 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 retractable wall is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- F. Dimensions: Fabricate retractable wall to form an assembled system of dimensions indicated and verified by field measurements.

- G. STC: Not less than 48 for the system.
- H. Panel Weight: 6 lb/sq. ft. maximum.
- I. Acoustical Panel Materials: Panels faced with steel sheets suitable for finish as indicated.
- J. Finish: Textile wall covering complying with the following requirements:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Carnegie Fabrics, LLC.; Pincrest or a comparable product approved prior to bidding.
 - 2. Performance: Type II per CCC-W-408D.
 - 3. Total Weight: 20 ounces.
 - 4. Width: 52 inches.
 - 5. Contents: Olefin composite.
 - 6. Features:
 - a. PVC free.
 - b. Heavy-metals free.
 - c. Halogenated-fire-retardant free.
 - d. Solvents.
 - e. Ozone-depleting chemicals.
 - 7. Colors, Textures, and Patterns: Product No. 8194-7
- K. Hardware: Manufacturer's standard as required to operate retractable wall; with decorative, protective finish.

2.3 SEALS

- A. Description: Seals that produce retractable acoustic walls 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 retractable wall perimeter and adjacent surfaces, when retractable wall is extended and closed.
- B. Sound Seals:
 - 1. Bottom Seals: Bottom seal automatically seals against floor, with not more than 2 inches between bottom of panel and floor finish.
 - 2. Wall Seals: Seal to wall track with no more than 3/4 inch between lifting mechanism and wall guide.
 - 3. Top Seals: Top seal automatically seals against the ceiling, with a joint of not more than 2 inches between top of panel and the ceiling of the pocket.
 - 4. Color: Black.

2.4 PANEL FINISH FACINGS

- A. Framework: Manufacturer's standard silver metallic.
- B. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

2.5 LIFTING SYSTEMS

- A. Lifting Mechanism: Designed to provide smooth, quiet operation. Chain or belt drive systems are not acceptable.
- B. Design Life: Sized to open and close wall over 10,000 cycles, at the minimum design speed of approximately 5 to 10 vertical feet per minute.
- C. Wire Rope: As required by manufacturer for each set of lifting mechanisms, sized to hold the entire weight of the wall, including a safety factor as recommended by manufacturer.
 - 1. Material: Galvanized steel.
- D. Power Drive: Sized to deliver sufficient amount of torque to safely and effectively raise and lower the operable wall over its design life.

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 retractable walls.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install retractable walls after other finishing operations, including painting, have been completed in area of retractable wall 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 seals are not acceptable.
- E. Light-Leakage Test: Illuminate one side of retractable wall installation and observe vertical joints and top and bottom seals for voids. Adjust retractable walls for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.3 ADJUSTING

- A. Adjust retractable walls, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. 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 retractable walls.

END OF SECTION 102241

SECTION 102600 – WALL AND DOOR PROTECTION

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. Corner guards.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
- C. Samples: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
 - 1. Corner Guards: 12 inches long.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Corner Guards: Furnish two of each type and size.

1.7 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.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: 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 E 84 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, Metal Corner Guards:
1. Basis-of-Design Product: Subject to compliance with requirements, provide inpro Corporation; Aluminum Corner Guard or a comparable product by one of the following:
 - a. Construction Specialties, Inc.
 - b. JL Industries; Activar Construction Products Group, Inc.
 - c. Koroseal Interior Products, LLC.
 2. Wing Size: 3/4 inch.
 3. Height: Top of base to ceiling, unless indicated otherwise.
 4. Angle: 90 degrees.
 5. Material: Extruded aluminum, minimum 0.0625 inch thick, with clear anodic finish.
 6. Material: Stainless Steel, type 304.
 7. Corner Radius: Manufacturer's standard.
 8. Mounting: Surface adhered.

2.4 MATERIALS

- A. Aluminum: 5005-H34 or 6063-T6 aluminum.
- B. Adhesive: As recommended by protection product manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.

2.5 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. 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.

2.6 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates 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.

3.4 CLEANING

- A. Remove excess adhesive using methods and materials recommended in writing by manufacturer.
- B. Clean corner guards according to manufacturer's instructions.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Childcare accessories.
 - 3. Underlavatory guards.
 - 4. Custodial accessories.

1.3 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of 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.
- B. Samples: Full size, for each exposed product and for each finish specified.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.
- D. Delegated Design Submittals: For grab bars.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, visible silver spoilage defects.
 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Owner Furnished Contractor Installed Accessories:
 1. Toilet tissue dispensers.
 2. Soap dispensers
 3. Paper towel dispensers.
 4. Sanitary napkin disposal units.
 5. Seat cover dispensers.
- C. Grab Bar:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick B-6806 or B-6861, as applicable to the application or comparable product by one of the following:
 - a. A&J Washroom Accessories, Inc.
 - b. American Specialties, Inc.; ASI Group.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
 - e. GAMCO Specialty Accessories; a division of Bobrick.

2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings

D. Mirror Unit:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick B-290 or comparable product by one of the following:
 - a. A&J Washroom Accessories, Inc.
 - b. American Specialties, Inc.; ASI Group.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
 - e. GAMCO Specialty Accessories; a division of Bobrick.
2. Frame: Stainless-steel channel Stainless steel, fixed tilt Stainless steel, adjustable tilt.
 - a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: As indicated on Drawings.

2.3 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

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. Plumberex Specialty Products, Inc.
 - b. Truebro by IPS Corporation.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.4 CHILDCARE ACCESSORIES

A. Diaper-Changing Station:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Koala Kare Products, a Division of Bobrick Washroom Equipment, Inc., KB200-SS or comparable product by one of the following:
 - a. American Specialties, Inc.; ASI Group.
 - b. Bradley Corporation.
 - c. Diaper Deck & Company, Inc.
 - d. GAMCO Specialty Accessories; a division of Bobrick.
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support minimum of 250-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: Stainless steel, ASTM A480/A480M No. 4 finish (satin), exterior shell with rounded plastic corners; HDPE interior in manufacturer's standard color.
6. Liner Dispenser: Built in.

2.5 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Mop and Broom Holder:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick B-239 or comparable product by one of the following:
 - a. A&J Washroom Accessories, Inc.
 - b. American Specialties, Inc.; ASI Group.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
 - e. GAMCO Specialty Accessories; a division of Bobrick.
2. Provide two units per closet.
3. Description: Unit with shelf, hooks and holders.
4. Length: 36 inches.
5. Hooks: Four.
6. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
7. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.

2.6 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Tape: Double-stick tape, 3M VHB, foam core, type as recommended by manufacturer for the application.
- H. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- I. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.7 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.
- C. Owner Furnished Contractor Installed Accessories: For accessories furnished by the Owner and installed on tile surfaces, use double-sided tape to install. Comply with manufacturer's instructions for surface preparation.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

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.
2. Show location of knockouts for hose valves.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 FIRE-PROTECTION CABINET

- 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. JL Industries; Activar Construction Products Group, Inc.
 - 2. Larsen's Manufacturing Company.
 - 3. Potter Roemer LLC; a Division of Morris Group International.
- B. Fire-Protection Cabinet Type: Suitable for fire extinguisher.
- C. Cabinet Construction: Nonrated.
- D. Cabinet Material: Aluminum sheet.
- E. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with rolled edge trim.
- F. Door Material: Aluminum sheet.
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Tempered float glass (clear).
- 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 lever handle with cam-action latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- J. Accessories:
 - 1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

K. Materials:

1. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
 - a. Finish: Clear anodic.
2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 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.
 5. Install door locks at factory.
- 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.

2.4 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 PREPARATION

3.2 INSTALLATION OF FIRE-PROTECTION CABINETS

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:
 - 1. Fire-Protection Cabinet Mounting Height: 48 inches above finished floor to top of fire extinguisher.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
- C. Identification:
 - 1. Apply vinyl lettering at locations indicated.

3.3 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

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers.

1.3 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.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
 - b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Activar Construction Products Group, Inc. - JL Industries.
 - b. Larsens Manufacturing Company.
 - c. Potter Roemer LLC; a Division of Morris Group International.
 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 3. Valves: Manufacturer's standard.
 4. Handles and Levers: Manufacturer's standard.
 5. 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. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
 1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

- a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 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.
 - 1. Mounting Brackets: Top of fire extinguisher to be at dimension indicated in Drawings, above finished floor.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105613 - METAL STORAGE SHELVING

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. Post-and-beam metal storage shelving.

1.3 COORDINATION

- A. Coordinate sizes and locations of blocking and backing required for installation of metal storage shelving attached to wall and ceiling assemblies.
- B. Coordinate locations and installation of metal storage shelving that may interfere with ceiling systems including lighting, HVAC, speakers, sprinklers, access panels, electrical switches or outlets, and floor drains.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal storage shelving.
- B. Shop Drawings: For metal storage shelving.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include installation details of connectors, lateral bracing, and special bracing.
- C. Samples: For each type of metal storage shelving and for each color specified, in the following sizes:
 - 1. Vertical Supports: 12 inches tall.
 - 2. Shelves: Full size, but not more than 24 inches wide by 12 inches deep.
 - 3. Connectors: Full size.
 - 4. Shelf-Label Holders: Full size.
- D. Delegated-Design Submittal: For seismic restraint of metal storage shelving.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For metal storage shelving, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of metal storage shelving.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal storage shelving to include in maintenance manuals.

1.7 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. Shelves: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 5 shelves.
 - 2. Shelf-to-Post Connectors: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 connectors.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install metal storage shelving until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for building occupants during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Metal storage shelving shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Seismic Component Importance Factor: 1.0.

2.2 POST-AND-BEAM METAL STORAGE SHELVING

- A. Post-and-Beam Metal Shelving: Complying with MH 28.2; field-assembled from factory-formed components. Shelves are supported by beams that span between supporting corner posts that allow beam-height adjustment over full height of shelving unit. Provide fixed top and bottom beams, adjustable intermediate beams, and accessories indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Penco Products, Inc.; Rivetrite Boltless, Heavy Duty, Single Rivet Shelving or comparable product by one of the following:
 - a. Borroughs Corporation.
 - b. Edsal Manufacturing Company, Inc.
 - c. EQUIPTO.
 - d. Lyon Workspace Products, LLC.
 - e. Mecalux.
 - f. Republic Storage Systems, LLC.
 - g. Rousseau Metal Inc.
 - h. Schaefer Systems International, Inc.
 - i. Tenssco.
 - j. UNICOR.
 - k. Western Pacific Storage Systems.
- B. Posts: Fabricated from cold-rolled steel; in manufacturer's standard shape with perforations at 1-1/2 inches o.c. to receive beam-to-post connectors.
 - 1. Unit Configuration: Configure shelving units as individual, freestanding assemblies.
 - 2. Steel Thickness, Nominal: 0.075 inch.
- C. Beams: Fabricated from cold-rolled steel; in manufacturer's standard shape. Provide beam at each side of each shelf, with center supports as required for load-carrying capacity of shelf.
 - 1. Steel Thickness, Nominal: 0.075 inch.
 - 2. Beam-to-Post Connectors: Projecting rivet at each end that engage posts.
 - a. Top and Bottom Shelf Beams: Provide with double beam-to-post connectors.
 - 3. Beam Quantity: As required for number of shelves indicated per shelving unit.
- D. Shelves: Welded steel wire; with 2-by-4-inch (51-by-102-mm) openings.
 - 1. Shelf Quantity: Three shelves per shelving unit.
- E. Overall Unit Width: 96 inches, inclusive of two end posts.
- F. Overall Unit Depth: 42 inches.
- G. Overall Unit Height: 120 inches.
- H. Capacity: 2,500 lbs per level in each unit.
- I. Accessories:

1. Tie Plates: Cold-rolled steel, finished to match posts; designed for joining posts of adjacent shelving units.
2. Supports: Back-to-wall and back-to-back type that bolt to posts; as required for shelving unit stability.

J. Steel Finish: Baked enamel.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.3 ANCHORS

- A. Floor Anchors: Galvanized-steel, post-installed expansion anchors. Provide number per unit recommended by manufacturer unless additional anchors are indicated in calculations.
- B. Wall Anchors: Manufacturer's standard, galvanized-steel anchors designed to secure metal storage shelving to adjacent wall. Provide one per shelving unit for each shelving unit adjacent to a wall unless additional anchors are indicated in calculations.

2.4 FABRICATION

- A. Fabricate metal storage shelving components to provide field-assembled units that are square and rigid, with posts plumb and true and shelves flat and free of dents or distortion. Fabricate connections to form a rigid structure, free of buckling and warping.
 1. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
 2. Build in straps, plates, brackets, and other reinforcements as needed to support shelf loading.
 3. Cut, reinforce, drill, and tap metal fabrications to receive hardware, fasteners, and similar items.
- B. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- C. Form edges and corners free of sharp edges or rough areas. Fold back and crimp exposed edges of unsupported sheet metal to form a hem on the concealed side; ease edges of metal plate to radius of approximately 1/32 inch. Shear and punch metals cleanly and accurately. Remove burrs.
- D. Weld corners and seams continuously to develop strength, minimize distortion, and maintain the corrosion resistance of base metals. At exposed locations, finish welds and surfaces smooth and blended so surface is smooth after finishing and contour of welded surface matches that of adjacent surface. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces before finishing.

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. Examine floors for suitable conditions where metal storage shelving will be installed.
- C. Examine walls to which metal storage shelving will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Vacuum and clean finished floor over which metal storage shelving is to be installed.

3.3 INSTALLATION

- A. Install metal storage shelving level, plumb, square, rigid, true, and with shelves flat and free of dents or distortion. Make connections to form a rigid structure, free of buckling and warping.
 - 1. Install exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 2. Install braces, straps, plates, brackets, and other reinforcements as needed to support shelf loading and as required for stability.
 - 3. Anchor shelving units to floor with floor anchors through floor plate. Shim floor plate to achieve level and plumb installation.
 - 4. Install seismic restraints.
 - 5. Install shelves in each shelving unit at spacing indicated on Drawings.
 - a. Post-and-Beam Metal Storage Shelving: Install beams with beam-to-post connectors fully engaged in post perforations.

3.4 ERECTION TOLERANCES

- A. Erect post-and-beam metal storage shelving to a maximum tolerance from vertical of 1/4 inch in 84 inches of height.

3.5 ADJUSTING

- A. Adjust metal storage shelving so that connectors and other components engage accurately and securely.
- B. Touch up marred finishes or replace metal storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal storage shelving manufacturer.

- C. Replace metal storage shelving components that have been damaged beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 105613

SECTION 10 5626 - MOBILE STORAGE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanically assisted systems.
2. Steel four-post shelving.

B. Related Requirements:

1. Section 012300 "Alternates" for requirements for submitting mobile shelving as an alternative to fixed shelving.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Mechanically assisted systems.
2. Steel four-post shelving.

B. Product Data Submittals: For each product.

1. Include mobile operation, construction details, material descriptions, dimensions of individual components and profiles, and finishes for mobile storage shelving systems and accessories.

C. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Show shelving layout.
3. Show location and extent of rail system.
4. Show clear-aisle widths from face of carriages.
5. Detail fabrication and installation of mobile shelving systems including methods of anchoring shelves to carriages and rails to building structure as required for seismic restraint.

D. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

E. Delegated Design Submittals: For mobile storage shelving, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Seismic Design Calculations: For seismic design of mobile storage shelving systems

including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mobile shelving systems and operating manuals to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating mobile storage shelving that meets or exceeds performance requirements indicated and of documenting this performance by test reports, and calculations.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- C. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of support rail anchors, depressed slab, embedded conduit, and other construction contiguous with mobile storage shelving by field measurements before fabrication.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of mobile shelving systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metals, metal finishes, and other materials beyond normal wear.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain mobile storage systems including shelving from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Mobile shelving systems are to withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Structural Performance: Provide mobile shelving systems capable of supporting the following:
 - 1. Total Load: 7,000 lb per carriage.
- C. Operating Force: For manually operated systems, maximum 1 lbf required to move 4,000 lb.

2.3 SYSTEMS AND COMPONENTS

- A. General: Provide manufacturer's standard mobile storage shelving systems and components. Where components are not otherwise indicated, provide manufacturer's standard components as required for a complete system.
- B. Inserts: Furnish required concrete inserts and similar anchorage devices for installing track system, and furnish other components of work where installation of devices is specified in another Section.
- C. Ramps: Manufacturer's standard metallic-coated, cold-rolled steel ramp not steeper than 1:12, with non-slip finish.
- D. Tracks: Steel rails with tops machined to mate with guide wheels and with ends designed to provide smooth, secure continuity between sections without field welding. Provide mounting brackets, anchorage devices, adjustable leveling devices, and stops at terminations of rails to prevent carriages from running off track ends.
 - 1. Mounting: Surface mounted.
- E. Carriages: Rigid frames consisting of C-shaped cold-formed steel beams and cross beams, designed to allow secure anchorage of shelving units.
 - 1. Carriage Width: 3 ft 6 inches nominal.
 - 2. Carriage Length: 8 feet 0 inches nominal.
 - 3. Wheels: Manufacturer's standard number of bearing-mounted, steel wheels, precision ground to mate with tracks.
 - 4. Bumpers: Provide two rubber bumpers with minimum depth of 1/2 inch each side.
- F. Anti-Tip Brackets: Mount on carriage for engagement with track system to secure units against tipping.
- G. Carriage End Panels: Full depth and height of shelving units. Provide at the operating end of each range.

1. Material: Cold-rolled steel sheet, 0.048 inch thick.

2.4 MECHANICALLY ASSISTED SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Spacesaver Corporation; ActivRAC7M or comparable product by one of the following:
 1. Borroughs Corporation
 2. Montel Inc.

2.5 POST-AND BEAM SHELVING

- A. Post-and-Beam Metal Shelving: Complying with MH 28.2; field-assembled from factory-formed components. Shelves are supported by beams that span between supporting corner posts that allow beam-height adjustment over full height of shelving unit. Provide fixed top and bottom beams, adjustable intermediate beams, and accessories indicated.
- B. Posts: Fabricated from cold-rolled steel; in manufacturer's standard shape with perforations at 1-1/2 inches o.c. to receive beam-to-post connectors.
 1. Unit Configuration: Configure shelving units as individual, freestanding assemblies.
 2. Steel Thickness, Nominal: 0.075 inch.
- C. Beams: Fabricated from cold-rolled steel; in manufacturer's standard shape. Provide beam at each side of each shelf, with center supports as required for load-carrying capacity of shelf.
 1. Steel Thickness, Nominal: 0.075 inch.
 2. Beam-to-Post Connectors: Projecting rivet at each end that engage posts.
 - a. Top and Bottom Shelf Beams: Provide with double beam-to-post connectors.
 3. Beam Quantity: As required for number of shelves indicated per shelving unit.
- D. Shelves: Welded steel wire; with 2-by-4-inch (51-by-102-mm) openings.
 1. Shelf Quantity: Three shelves per shelving unit.
- E. Overall Unit Width: 96 inches, inclusive of two end posts.
- F. Overall Unit Depth: 42 inches.
- G. Overall Unit Height: 120 inches.
- H. Capacity: 2,500 lbs per level in each unit.

2.6 STEEL FINISHES

- A. 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.

- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to achieve a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: Custom color as selected by Architect.

2.7 SYSTEM ACCESSORIES

- A. Floor Lock: Key-operated floor lock capable of securing entire system. Provide four keys.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of mobile shelving systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Level and plumb tracks to a tolerance of 0.09 inch in 120 inches with no more than 0.06-inch variation between adjacent rails. Use permanent shims or non-shrink grout as indicated by manufacturer.
- B. Surface-Mounted Track Systems: Install underlayment, ramps, and finish flooring according to manufacturer's written instructions and flush with track surfaces. Do not extend ramps beyond ends of carriages.
- C. Carriage Installation: Mount mobile carriages on track system with anti-tip brackets engaged by rails and adjust for smooth operation. Provide non-moving carriages securely fixed to rails where indicated.

3.3 CLEANING AND PROTECTING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- C. Protect installed products from damage during remainder of the construction period.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain mobile storage shelving.

3.5 PROTECTION

- A. Protect system against damage during remainder of construction period. Advise Owner of additional protection needed to ensure that system will be without damage or deterioration at time of substantial completion.

END OF SECTION 105626

SECTION 107516 - GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes ground-set flagpoles made from aluminum.
- B. Owner-Furnished Material: Flags.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Shop Drawings: For each flagpole.
 - 1. Include the following
 - a. Plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
 - b. Section, and details of foundation system.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Flagpole assemblies to withstand the effects of earthquake motions determined according to ASCE/SEI 7 .

- B. Structural Performance: Flagpole assemblies, including anchorages and supports, to withstand design loads indicated within limits and under conditions indicated.
 - 1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is 120 MPH .
 - 2. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.3 ALUMINUM FLAGPOLES

- A. Aluminum Flagpoles: Cone -tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.
 - 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. American Flagpole.
 - b. Baartol Company.
 - c. Concord Industries, Inc.
 - d. Eder Flag Manufacturing Company, Inc.
 - e. Ewing Flagpoles.
- B. Exposed Height: 35 feet.
- C. Quantity: Three, as indicated above.
- D. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
 - 1. Fabricate shop and field joints without using fasteners, screw collars, or lead caulking.
 - 2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
- E. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch- diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.
 - 1. Flashing Collar: Same material and finish as flagpole.

2.4 FITTINGS

- A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
 - 1. 0.063-inch spun aluminum with gold anodic finish.
- B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured thumb turn. Finish truck assembly to match flagpole.
 - 1. Halyard Flag Snaps: Stainless steel swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.

2. Halyard with Integral Lighting Beacon: Basis-of-Design: American Beacon Flagpole Lighting: Beacon Plus – Dual Light, ABW2-35FS-SAT.
 - a. Dual light, 12 volt system with driver contained inside the truck.
 - b. Total Lumens: 572.
 - c. Beacon Size: 6 inch diameter.
 - d. Power: 110V/120V input, 12V output.
 - e. LED Bulbs: 3000K, warm white, MR8, rated for 25,000 hours.
 - f. Provide wire for height of flagpole plus 10 ft.
 - g. Standard 1-1/4 in. NPT spindle.
 - h. Standard 1/2 in, 13NC, top drilling.

2.5 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.
- B. Sand: ASTM C33/C33M, fine aggregate.
- C. Elastomeric Joint Sealant: joint sealant complying with requirements in Section 079200 "Joint Sealants."
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.
- D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.
- E. Place concrete, as specified in Section 033000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.
- F. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.
- B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 107516

__SECTION 113013 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cooking appliances.
 - 2. Refrigeration appliances.
 - 3. Cleaning appliances.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Cooking appliances.
 - 2. Refrigeration appliances.
 - 3. Cleaning appliances.
- B. Product Data Submittals: For each product.
 - 1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.
- D. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of appliance.
- C. Sample Warranties: For manufacturers' special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 WARRANTY

- A. General Warranty: 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 Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Electric Cooktop and Range: Limited warranty, including parts and labor for first year and parts thereafter, <Insert description> for on-site service on surface-burner elements.
 - a. Warranty Period: Five years from date of Substantial Completion.
2. Microwave Oven: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the magnetron tube.
 - a. Warranty Period: Five years from date of Substantial Completion.
3. Refrigerator/Freezer, Freezer, and Icemaker, Sealed System: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the product.
 - a. Warranty Period for Sealed Refrigeration System: Five years from date of Substantial Completion.
 - b. Warranty Period for Other Components: Five years from date of Substantial Completion.
4. Dishwasher: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the product.
 - a. Warranty Period for Deterioration of Tub and Metal Door Liner: 10 years from date of Substantial Completion.
 - b. Warranty Period for Other Components: Two years from date of Substantial Completion.
5. Clothes Washer and Dryer: Full warranty, including parts and labor, for on-site service on the product.
 - a. Warranty Period: Five years from date of Substantial Completion.
6. Ice Maker: Full warranty, including parts and labor:

- a. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain residential appliances from single source.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design, and ICC A117.1.

2.3 COOKING APPLIANCES

- A. Electric Range: Freestanding range with one oven(s) and complying with AHAM ER-1.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Whirlpool Corporation; Model No. WFE550S0HZ or comparable product by one of the following:
 - a. GE Appliances; Haier Group
 - b. Maytag; Whirlpool Corporation
 2. Width: 30 inches.
 3. Electric Burner Elements: Four.
 - a. Coil Type: Two 6-inch 1200 W, one 9-inch 2500 W and one 6/9-inch 3000 W.
 - b. Controls: Digital panel controls, located on splash panel at rear of rangetop.
 4. Oven Features:
 - a. Capacity: 5.3 cu. ft.
 - b. Operation: convection.
 - c. Oven Door(s): Counterbalanced, removable, with observation window, and towel-bar type handle.
 - d. Electric Power Rating:
 - 1) Oven(s): Manufacturer's standard.
 - 2) Broiler: Manufacturer's standard.
 - e. Controls: Digital panel controls and timer display, located on splash panel

at rear of rangetop.

5. Anti-Tip Device: Manufacturer's standard.
6. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A.
7. Material: Stainless steel with black ceramic-glass cooktop.

B. Microwave Oven:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Whirlpool Corporation; Model No. WMCS7022PZ or comparable product by one of the following:
 - a. GE Appliances; Haier Group
 - b. Maytag; Whirlpool Corporation
2. Mounting: Countertop or wall cabinet.
3. Type: Conventional.
4. Dimensions:
 - a. Width: 21-3/4 inches.
 - b. Depth: 18-5/16 inches.
 - c. Height: 12-3/4 inches.
5. Capacity: 1.6 cu. ft.
6. Oven Door: Door with observation window and pushbutton latch release.
7. Microwave Power Rating: 1200 W.
8. Electric Power Supply: 120 V, 60 Hz, 1 phase, 15 A.
9. Controls: Digital panel controls and timer display.
10. Other Features: Turntable, lock-out feature, and sensor cooking.
11. Material: Stainless steel.

2.4 REFRIGERATION APPLIANCES

A. Refrigerator/Freezer: Two-door refrigerator/freezer with freezer on top and complying with AHAM HRF-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Whirlpool Corporation; Model No. WRT541SZDZ or comparable product by one of the following:
 - a. GE Appliances; Haier Group
 - b. Maytag; Whirlpool Corporation
2. Type: Freestanding.
3. Dimensions:
 - a. Width: 33 inches.
 - b. Depth: 34 inches.
 - c. Height: 66-1/4 inches.

4. Storage Capacity:
 - a. Refrigeration Compartment Volume: 15 cu. ft.
 - b. Freezer Volume: 6 cu. ft.
 - c. Shelves: Three adjustable glass shelves.
 5. Refrigerator Features:
 - a. Interior light in refrigeration compartment.
 - b. Compartment Storage: Vegetable crisper, and meat compartment.
 - c. Door Storage: Modular compartments.
 - d. Temperature-controlled meat/deli bin.
 - e. Fingerprint resistant.
 6. Freezer Features: One freezer compartment with door.
 - a. Automatic defrost.
 - b. Interior light in freezer compartment.
 - c. Automatic icemaker and storage bin.
 - d. "EZ connect Icemaker Kit."
 7. Appliance Color/Finish: Stainless steel.
- B. Undercounter Refrigerator: Two-door refrigerator/freezer with freezer on top and complying with AHAM HRF-1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Whirlpool Corporation; Model No. WUR35X24HZ or comparable product by one of the following:
 - a. GE Appliances; Haier Group
 - b. Maytag; Whirlpool Corporation
 2. Dimensions:
 - a. Width: 24 inches.
 - b. Depth: 26 inches.
 - c. Height: 35 inches.
 3. Storage Capacity:
 - a. Refrigeration Compartment Volume: 5.1 cu. ft.
 - b. Shelves: Three glass shelves, one fixed, two adjustable.
 4. Refrigerator Features:
 - a. Automatic defrost.
 - b. Temperature sensor.
 - c. Door Storage: Two removable bins.
 - d. Fingerprint resistant.

5. Appliance Color/Finish: Stainless steel.

C. Icemaker:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Scotsman HID525A-1 with HST21-A Stand with 6-inch adjustable legs. or comparable product by one of the following:

a. Manitowoc Ice.

2. Type: Freestanding.

3. Dimensions:

a. Width: 24-1/4 inches.

b. Depth: 24-1/2 inches.

c. Height: 35 inches.

4. Ice Capacity:

a. Production: 500 lb per day.

5. Features:

a. Self-cleaning cycle.

6. Appliance Color/Finish: Stainless steel.

2.5 CLEANING APPLIANCES

A. Dishwasher: Complying with AHAM DW-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Whirlpool Corporation; Model No. WDF330PAHS or comparable product by one of the following:

a. GE Appliances; Haier Group

b. Maytag; Whirlpool Corporation

2. Type: Built-in undercounter.

3. Dimensions:

a. Width: 24 inches.

b. Depth: 24-1/2 inches.

c. Height: 34-1/2 inches.

4. Sound Level: Maximum 55 dB.

5. Tub and Door Liner: Manufacturer's standard with sealed detergent and automatic rinsing-aid dispensers.

6. Controls: Push button controls with three wash cycles and hot-air and heat-off drying cycle options.

7. Features:
 - a. Detergent dispenser.
 - b. High temperature wash system.
 - c. Delay-wash option.
 - d. Digital display panel.
 8. Appliance Color/Finish: Stainless steel.
- B. Clothes Washer: Complying with AHAM HLW-1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Speed Queen; Model No. TC5003WN or comparable product by one of the following:
 - a. GE Appliances; Haier Group
 - b. Maytag; Whirlpool Corporation
 - c. Whirlpool Corporation
 2. Type: Freestanding, top-loading unit.
 3. Dimensions:
 - a. Width: 25-5/8 inches.
 - b. Depth: 28 inches.
 - c. Height: 42-3/4 inches.
 4. Drum: Perforated stainless steel.
 - a. Capacity: 3.2 cu. ft.
 5. Controls: Rotary-dial controls for water-fill levels, wash/rinse water temperatures, load size, and variable-speed and fabric selectors.
 - a. Wash Cycles: Six wash cycles, including regular, delicate, and permanent press.
 - b. Wash Temperatures: Four settings.
 - c. Speed Combinations: Two.
 6. Electrical Power: 120 V, 60 Hz, 1 phase, 15 A.
 7. Motor: Manufacturer's standard with built-in overload protector.
 8. Features:
 - a. Self-cleaning lint filter.
 - b. Unbalanced-load compensator.
 - c. Self-leveling legs.
 - d. Spin-cycle safety switch.
 - e. End-of-cycle signal.
 - f. Extra-rinse option.
 - g. Water levels automatically set.
 9. Appliance Finish: Enamel.

- a. Color: White.
- C. Clothes Dryer: Complying with AHAM HLD-1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Speed Queen; Model No. DC5003WG or comparable product by one of the following:
 - a. GE Appliances; Haier Group
 - b. Maytag; Whirlpool Corporation
 - c. Whirlpool Corporation
 2. Type: Freestanding, frontloading, gas unit.
 3. Dimensions:
 - a. Width: 27 inches.
 - b. Depth: 28 inches.
 - c. Height: 42-3/4 inches.
 4. Drum: Manufacturer's standard.
 - a. Capacity: 7.0 cu. ft.
 5. Controls: Rotary-dial controls for drying cycle, temperatures, and fabric selectors.
 6. Gas-Dryer Power: 120 V, 60 Hz, 1 phase, 15 A electric; 22,000-Btu/h gas.
 7. Features:
 - a. Removable lint filter.
 - b. End-of-cycle signal.
 - c. Interior drum light.
 - d. Self-leveling legs.
 - e. Antibacterial cycle.
 8. Appliance Finish: Enamel.
 - a. Color: White.

2.6 ACCESSORIES

- A. Provide hoses, power cords and other accessories required to connect the appliances to building utilities.

2.7 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the

range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After installation, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. An appliance will be considered defective if it does not pass tests and inspections.

- C. Prepare test and inspection reports.

END OF SECTION 113013

SECTION 116615 - SCHOOL EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following equipment to be contractor provided and installed:
 - 1. Chemical Storage.
 - 2. Audiometric Test Booth.
- B. Related Sections include the following:
 - 1. Division 26 Sections for electrical service systems.

1.3 SUBMITTALS

- A. Product Data: For each item of equipment, include manufacturer's standard details and installation and maintenance instructions.
- B. Shop Drawings:
 - 1. For each item of storage cabinetry, include plans, elevations, and details of typical members and other components. Show layout and installation details, including anchorage details.
 - 2. For all equipment provided as work of this Section, show dimensions of units with required clearances for safety and maintenance operations.
 - 3. Wiring Diagrams: Detail wiring for shop equipment. Differentiate between manufacturer-installed and field-installed wiring.
 - a. Show locations of connections to electrical service provided in other Sections.
- C. Maintenance Data: For equipment components to include in the maintenance manuals specified in Division 1.
- D. Maintenance Instructions: Manufacturer's written instructions for maintenance of equipment.
 - 1. Include recommended methods and frequency for maintaining equipment in optimum operating condition under anticipated use conditions.
 - 2. Include precautions against materials and methods that may be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

- A. Owner's required equipment is specified herein.
 - 1. Do not modify intended design concept, as judged solely by Architect, except with Architect's approval and only to extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering equipment that may be incorporated into the Work include, but are not limited to, those listed for each item.

2.2 CHEMICAL STORAGE

- A. Hazardous Material Cabinet: Wall mount, 12 gallon, 2-door self-closing cabinet; equal to Justrite Model 861328.
 - 1. Size: 18 inches high by 43 inches wide by 18 inches deep.
- B. Flammable Safety Cabinet: Wall mount, 2-door self-closeing cabinet; equal to Justrite Model 891320.
 - 1. Size: 18 inches high by 43 inches wide by 18 inches deep.

2.3 AUDIOMETRIC TEST BOOTH

- A. Booth: Single wall design, soundproof acoustic booth, equal to ETS-Lindgren; Acoustic Systems Model No. RE-143MC.
 - 1. Exterior Size: 8 ft wide by 7 feet 8 inches long by 8 ft 1-5/8 inches high.
 - 2. Electrical: 110 VAC, 20 Amp.
 - 3. Ventilation: Acoustically engineered system with variable speed inline fan.
 - 4. Floor: 3 inch floor system on 1-5/8 inch isolation rails.
 - 5. Door: 36 inch clear opening, out swing with 20 by 60 inch lite.
 - 6. Window: 30 by 24 inch.
 - 7. Window Frame color: Match booth.
 - 8. Trim: Provide vertical trim pieces to extend roof apron above the booth.

2.4 ACCESSORIES

- A. General: Provide anchor bolts and other accessory items as required for installation and operation. Hot-dip galvanize anchor bolts and other accessory items according to ASTM A 153/A 153M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Before installation, examine areas to receive equipment. Verify that critical dimensions are correct, and conditions are acceptable.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install equipment according to manufacturer's written instructions and placement drawings.
- B. Equipment included in allowances is also work of this Section for placement and connection to utilities.

3.3 AUDIOMETRIC TEST BOOTH INSTALLATION

- A. Install with 4 inch clearance between host walls.
- B. Pit Recess: Provide 4-3/4 inch pit recess from bottom of pit to top of finish floor, and level within 1/8 inch over 10 ft.
 - 1. Pit Dimensions: Booth footprint plus 4 inches in each direction.
- C. Install the door/window side of the booth flush to the pit edge without making contact.
- D. Do not hard couple utilities, soffits or other construction between booth and host room.

3.4 CLEANING AND PROTECTING

- A. After installing clean finished surfaces, touch up shop-applied finishes as required to restore damaged areas.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure equipment is without damage or deterioration at the time of Substantial Completion.

3.5 DEMONSTRATION

- A. Instruct Owner's maintenance personnel on proper operation and maintenance of equipment. Train personnel on procedures to follow if machinery fails or malfunctions.

3.6 EQUIPMENT LIST

END OF SECTION 116615

SECTION 116800 - PLAY FIELD EQUIPMENT AND STRUCTURES

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 playground equipment as follows:
 - 1. Freestanding playground equipment.
 - 2. Composite playground equipment.

1.3 DEFINITIONS

- A. Definitions in ASTM F1487 apply to Work of this Section.
- B. IPEMA: International Play Equipment Manufacturers Association.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Shop Drawings: For each type of playground equipment.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include fall heights and use zones for playground equipment, coordinated with the critical-height values of protective surfacing specified in Section 321816.13 "Playground Protective Surfacing."
- D. Samples for Initial Selection: For each type of exposed finish.
 - 1. Manufacturer's color charts.
 - 2. Include Samples of accessories involving color selection.
- E. Samples for Verification: For each type of exposed finish on the following products:
 - 1. Include Samples of accessories to verify color and finish selection.

2. Posts and Rails: Minimum 6 inches long.
3. Platforms: Minimum 6 inches square.
4. Molded Plastic: Minimum 3 inches square.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Product Certificates: For each type of playground equipment.
- C. Material Certificates: For the following items:
 1. Shop finishes.
- D. Field quality-control reports.
- E. Sample Warranty: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain playground equipment from single source from single manufacturer.

- B. Playground equipment and components shall have the IPEMA Certification Seal.

2.2 PERFORMANCE REQUIREMENTS

- A. Safety Standard: Provide playground equipment according to ASTM F1487.

2.3 COMPOSITE PLAYGROUND EQUIPMENT

- A. Composite Play Structure - Kindergarten - Integral play assembly that provides more than one play activity; manufactured as a system or assembled from manufacturer's standard modular-sized units.

1. Miracle Recreation Inc. or Approved Equal
2. Metal Frame: Galvanized-steel and Aluminum pipe or tubing connected with bolts or clamps.
 - a. Main Frame Posts: Not less than 3-1/2 -inch OD.
 - b. Color: As selected by Architect from manufacturer's full range.
3. Platforms: Perforated metal.
 - a. Color: As selected by Architect from manufacturer's full range.
4. Roofs: Plastic.
 - a. Color: As selected by Architect from manufacturer's full range.
5. Play Structure Access Component(s): Ladder, Stairs, Ramp, Accessible crawl ramp, or Accessible transfer platform.
 - a. Handholds: Protective barriers, Guardrails, Handrails or Handholds on each side.
6. Equipment - Playground Kindergarten: Include the following play event components:
 - a. Whirl – 303
 - b. Boulder Climbing Tunnel – 818-1
 - c. Tic-Tac-Toe (Below Deck) – 704-763-2B
 - d. (2) Twin Rider – 608-1
 - e. Saddle Seat Straight Post – 945-2
 - f. (2) 1' Deck – 704-503-9
 - g. (2) 1'-6" Deck – 704-503-9
 - h. (2) 2' Deck – 704-503-9
 - i. 5' Deck – 704-502-9
 - j. Tree House Roof – 704-730-9
 - k. (2) 8' PVC Ramp – 704-704-59
 - l. 12' PVC Ramp – 704-920-595
 - m. Typhoon II 360 One Piece 704-748-59
 - n. Chameleon II – 704-670-1
 - o. Ski Slide – 704-910
 - p. Stair Between Decks 3' Rise – 704-881-9
 - q. Vertical Ladder – 704-815
 - r. Pilot Panel w/ Window – 704-714-6
 - s. Marble Races Panel – 704-983-1

- t. Motor Skills Panel – 704-983-2
 - u. (2) Fun Fone – 704-994
 - v. Critter Puzzle Panel – 704-763-1
 - w. (4) Deck Encl – 704-8143-5
 - x. Kids' Perch Panel w/ Extended Wheel – 704-715-13
 - y. Sign Language Panel – 704-715-10
 - z. Interaxion Bridge – 433-3
 - aa. (8) Bongo Perch – 704-772-1
 - bb. Colors: As selected by Architect from manufacturer's full range.
- 7. Arrangement: As indicated on Drawings.
 - 8. Capacity: 40 users.
 - 9. Age Appropriateness: Two through 12 years.
- B. Composite Play Structure - Grades 1-3: Integral play assembly that provides more than one play activity; manufactured as a system or assembled from manufacturer's standard modular-sized units.
- 1. Miracle Recreation Inc. or Approved Equal
 - 2. Metal Frame: Galvanized-steel and Aluminum pipe or tubing connected with bolts or clamps.
 - a. Main Frame Posts: Not less than 3-1/2 -inch OD.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 3. Platforms: Perforated metal.
 - a. Color: As selected by Architect from manufacturer's full range.
 - 4. Roofs: Plastic.
 - a. Color: As selected by Architect from manufacturer's full range.
 - 5. Play Structure Access Component(s): Ladder, Stairs, or Accessible transfer platform.
 - a. Handholds: Protective barriers, Guardrails, Handrails, Handholds on each side.
 - 6. Equipment: include the following Play event components:
 - a. Ten Spin – 304
 - b. Critter Puzzle (Below Deck) – 718-763-1B
 - c. (2) Twin Rider – 608-1
 - d. (2) Saddle Seat Straight Post – 945-2
 - e. Saddle Seat Angle Post – 945-1
 - f. (2) Fun Fone – 718-994
 - g. Wall W/ Wheel – 718-900
 - h. ½ Calypso 2- Drum (Below Deck) – 718-715-13HB
 - i. 5' Deck – 718-504-9
 - j. 3' Deck – 718-502-9
 - k. Square Roof – Shingle – 718-861-4
 - l. ATA Steps – 718-959-9
 - m. Square Transfer Point Deck – 718-851-39
 - n. Trap Door Climber – 718-731
 - o. Tot Rock Climber – 7180787

- p. (2) Groove II Slide – 718-638-5
 - q. L-Slide – 718-907-1
 - r. (2) Balance Beam – 718-913
 - s. Jax Beanstalk Two – 477-502
 - t. (9) Bongo Perch – 718-772-1
 - u. Colors: As selected by Architect from manufacturer's full range.
- 7. Arrangement: As indicated on Drawings.
 - 8. Age Appropriateness: Five through 12 years.
- C. Composite Play Structure - Grades 4-6: Integral play assembly that provides more than one play activity; manufactured as a system or assembled from manufacturer's standard modular-sized units.
- 1. Miracle Recreation Inc. or Approved Equal
 - 2. Metal Frame: Galvanized-steel and Aluminum pipe or tubing connected with bolts or clamps.
 - a. Main Frame Posts: Not less than 3-1/2 -inch OD.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 3. Platforms: Perforated metal.
 - a. Color: As selected by Architect from manufacturer's full range.
 - 4. Roofs: Plastic.
 - a. Color: As selected by Architect from manufacturer's full range.
 - 5. Play Structure Access Component(s): Ladder, Stairs, or Accessible transfer platform.
 - a. Handholds: Guardrails, Handrails, Handholds on each side.
 - 6. Equipment Playground A: Include the following play event components:
 - a. Jumping Bean - 944
 - b. Saddle Seat Straight Post – 945-2
 - c. Saddle Seat Angled Post – 945-1
 - d. Maypole – 763
 - e. Crunch Station – 704-782
 - f. Bell (Post Mount) - 704-796- P1m
 - g. 3'- Deck – 704-502-9
 - h. (2) 5' Deck – 704-502-9
 - i. Deck ENCL – 704-813-5
 - j. (2) Square Roof – 704-861-4
 - k. Arch Bridge – 7040970-49
 - l. ADA Steps 2' Rise – 704-959-49
 - m. Square Transfer Point, 3' Deck – 704-851-359
 - n. End Ladder – 704-813-53
 - o. Climbing Pole – 704-808
 - p. Typhoon II 360 One Piece – 704-748-59
 - q. Groove II Slide – 704-638-5
 - r. (2) 4' Cargo Climb Over – 714-845-645
 - s. (17) Bongo Perch – 714-772-1

- t. Wavy Wedge Wall Walker – 704-608-5
 - u. Wave Walker, 2-Way – 459-2
 - v. Serpent Climber – 704-722-5
 - w. Curved Tensile Climber – 704-917-3
 - x. Flip Flop Climber – 434
 - y. Camel Back Climber – 448-2
 - z. Twister Climber – 704-848-5
 - aa. Colors: As selected by Architect from manufacturer's full range.
7. Arrangement: As indicated on Drawings.
8. Age Appropriateness: Five through 12 years.

2.4 FABRICATION

- A. Provide sizes, strengths, thicknesses, wall thickness, and weights of components as required to comply with requirements in ASTM F1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structures, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required for equipment indicated.
- B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as required. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.
- C. Composite Frame: Fabricate main-frame upright support posts from metal and plastic. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.
- D. Play Surfaces: Manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces, designed to withstand loads; fabricated from perforated or expanded metal made into floor units with slip-resistant finish. Fabricate units in modular sizes and shapes to form assembled play surfaces indicated.
- E. Protective Barriers: Fabricate according to ASTM F1487. Extend barriers to height above the protected elevated surface according to requirements for use by age group indicated. Fabricate from one or more of the following:
- 1. Welded-metal pipe or tubing with vertical bars.
 - 2. Steel sheet with openings for vision and ventilation.
 - 3. Metal-pipe or -tubing frame with wire-mesh infill panels.
 - 4. Opaque plastic panels with openings.
- F. Guardrails: Provide guardrails configured to completely surround the protected area, except for access openings. Fabricate from welded metal pipe or tubing. Extend guardrails according to requirements for use by age group indicated.
- G. Handrails: Welded metal pipe or tubing, maximum OD between 0.95 and 1.55 inches.
- 1. Provide handrails at heights to comply with requirements for use by age group indicated according to ASTM F1487.

- H. Roofs and Canopies: Designed to discourage and minimize climbing by users.
 - 1. Fabricated from opaque plastic.
- I. Signs: Manufacturer's standard sign panels, fabricated from opaque plastic with graphics molded in, attached to freestanding, upright support posts.
 - 1. Text: Minimum informational content according to ASTM F1487.
 - 2. Colors: As selected by Architect from manufacturer's full range.

2.5 MATERIALS

- A. Aluminum: Material, alloy, and temper recommended by manufacturer for type of use and finish indicated.
- B. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated.
- C. Stainless-Steel Sheet: Type 304; finished on exposed faces with No. 2B finish.
- D. Opaque Plastics: Color impregnated, UV stabilized, and mold resistant.
- E. Iron Castings and Hangers: Malleable iron, ASTM A47/A47M, Grade 32510, hot-dip galvanized.
- F. Post Caps: Cast aluminum or color-impregnated, UV-stabilized, mold-resistant polyethylene or polypropylene; color to match posts.
- G. Platform Clamps and Hangers: Cast aluminum or zinc-plated steel, not less than 0.105-inch-nominal thickness.
- H. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a vandal-resistant design.
- I. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or zinc-plated steel and iron, or stainless steel; permanently capped; and theft resistant.

2.6 CAST-IN-PLACE CONCRETE

- A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch- maximum-size aggregate.

2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils, medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
- B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

2.8 IRON AND STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for pretreatment, applying, and baking.
- B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

2.9 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.
 - 1. Maximum Equipment Height: Coordinate installed fall heights of equipment with finished elevations and critical-height values of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.
- B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.
- C. Post Set with Concrete Footing: Comply with Section 033000 "Cast-in-Place Concrete" for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.
 - a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.
3. Finishing Footings: Smooth top, and shape to shed water.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
 1. Perform inspection and testing for each type of installed playground equipment according to ASTM F1487.
- C. Playground equipment items will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Notify **Owner** 48 hours in advance of date(s) and time(s) of testing and inspection.

END OF SECTION 116800

SECTION 122413 - ROLLER WINDOW SHADES

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. Manually operated roller shades with single rollers.

- 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.

1.3 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.

- C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

- D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.8 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.

1.9 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 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- 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. Draper Inc.
 - 2. MechoShade Systems, Inc.
- B. 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: Stainless steel.

- a. Loop Length: Full length of roller shade.
 - b. Chain-Retainer Type: Chain tensioner, sill mounted.
- C. 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 unless indicated otherwise or required for operation.
 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. 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.
- F. Installation Accessories:
1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 3 inches .
 2. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 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 - **RS1**: Woven fabric, stain and fade resistant.
1. Source: Roller shade manufacturer.
 - a. Design Standard: Mechoshade "Ecoveil" shadecloth.
 2. Type: Thermoplastic Olefin.
 3. Weave: Basketweave.
 4. Roll Width: 126 inches.
 5. Orientation on Shadeband: Up the bolt.
 6. Openness Factor: 3 percent.
 7. Color: As selected by Architect from manufacturer's full range.

2.4 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 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.
- B. Roller Shade Locations: As indicated on Drawings.

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.

END OF SECTION 122413

SECTION 123616 - METAL COUNTERTOPS

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. Stainless-steel countertops.
- B. Related Requirements:
 - 1. Section 064116 "Plastic-Laminate-clad Architectural Cabinets" for concealed brackets.

1.3 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 wall-mounted shelves.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For metal fabrications.
 - 1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
 - 2. For countertops, show locations and sizes of cutouts and holes for items installed in metal countertops.
 - 3. For wall-mounted shelves, indicate requirements for blocking or reinforcements in supporting construction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products only after casework and supports on which they will be installed has been completed in installation areas.
- B. Keep finished surfaces of products covered with polyethylene film or other protective covering during handling and installation.

1.6 FIELD CONDITIONS

- A. Field Measurements: Where products 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.
- B. Established Dimensions: Where products are indicated to fit to other construction, establish dimensions for areas where products 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 STAINLESS-STEEL FABRICATIONS

- A. Countertops: Fabricate from 0.062-inch- thick, stainless-steel sheet. Provide smooth, clean exposed tops and edges in uniform plane, free of defects. Provide front and end overhang of 1 inch over the base cabinets.
 - 1. Joints: Fabricate countertops without field-made joints.
 - 2. Weld shop-made joints.
 - 3. Sound deaden the undersurface with heavy-build mastic coating.
 - 4. Extend the top down to provide a 1-inch- thick edge with a 1/2-inch return flange.
 - 5. Form the backsplash coved to and integral with top surface, with a 1/2-inch- thick top edge and 1/2-inch return flange.

2.2 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Sealant for Countertops: Manufacturer's standard sealant that complies with applicable requirements in Section 079200 "Joint Sealants" and the following:
 - 1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone.
 - 2. Color: As selected by Architect from manufacturer's full range.
 - 3. Sealant shall have a VOC content of 250 g/L or less.

2.3 STAINLESS-STEEL FINISH

- A. Grind and polish surfaces to produce uniform, directional satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

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 products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install metal countertops level, plumb, and true; shim as required, using concealed shims.
- B. Field Jointing: Where possible, make field jointing in the same manner as shop jointing; use fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
- C. Secure countertops to cabinets with Z- or L-type fasteners or equivalent; use two or more fasteners at each front, end, and back.
- D. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.
- E. Seal junctures of countertops, splashes, and walls with sealant for countertops.

3.3 CLEANING AND PROTECTION

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces. Remove and replace damaged products or touch up and refinish damaged areas to match original factory finish, as approved by Architect.
- C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123616

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad countertops.
2. Accessories.

B. Related Requirements:

1. Section 064023 "Interior Architectural Woodwork" for concealed brackets, plastic-laminate-clad cabinets and fabricators.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Plans, sections, details, edge and backsplash profiles, and attachments to other work.
2. Locations and details of joints.
3. Locations and sizes of cutouts and holes for items installed in countertop.

C. Samples for Initial Selection: Plastic laminates in each type, color, pattern, and surface finish required in manufacturer's standard size.

D. Samples for Verification:

1. Plastic Laminates: For each type, color, pattern, and surface finish required, 8 by 10 inches in size.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For the following:

1. Composite wood products.
2. High-pressure decorative laminate.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
- B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.6 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

- A. Fabricators: Provide countertops from the same fabricator that is providing the cabinets.
- B. Quality Standard: Unless otherwise indicated, comply with NAAWS for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.
- C. Grade: Match related casework.
- D. High-Pressure Decorative Laminate: ISO 4586-3, Grade HGS.
 - 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. Formica Corporation.
 - b. Laminart LLC.
 - c. Nevamar Company, LLC.
 - d. Pionite; a Panolam Industries International, Inc. brand.
 - e. Wilsonart LLC.
- E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. If not indicated in the Drawings, then as selected by Architect from manufacturer's full range in the following categories:
 - a. Patterns, matte finish.
- F. Edge Treatment: PVC edging.
- G. Core Material: MDF.
- H. Core Thickness: 3/4 inch.

1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

- I. Backer Sheet: Provide plastic-laminate backer sheet, ISO 4586-3, grade to match exposed surface, on underside of countertop substrate.

2.2 ACCESSORIES

A. Grommets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Doug Mockett & Company, Inc.; LO Large 6" Oval Grommet King Kong or a comparable product by one of the following:
 - a. Hafele America Co.
 - b. W.W. Grainger, Inc.
2. Wire-Management Grommets: Circular, grommets and matching caps with slot for wire passage. Include cap and liner.
 - a. Finish: Molded plastic.
 - b. Size: 2-1/2 inches by 6 inches.
 - c. Color: Black.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
- B. Composite Panel Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
 1. Medium-Density Fiberboard (MDF): ANSI A208.2.
 - a. Grade 130.

2.4 MISCELLANEOUS MATERIALS

- A. Adhesive for Bonding Plastic Laminate: Type II water-resistant type as selected by fabricator to comply with requirements.
 1. Adhesive for Bonding Edges: Hot-melt adhesive.
- B. Installation Adhesive: Manufacturer's standard product that is recommended for application indicated.
 1. Verify adhesives have a VOC content of 70 g/L or less.

2.5 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
- B. Complete fabrication, including assembly, 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. Notify Architect seven days in advance of dates and times countertop fabrication will be complete.
 - 2. Trial fit assemblies at fabrication 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, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of cutouts by saturating with varnish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.3 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to extent that it was not completed in the shop.
 - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where indicated on Shop Drawings.
1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Countertop Installation:
1. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 2. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 3. Anchor wall cleating necessary for proper setting for countertops not supported by casework.
 4. Install countertops level and true in line. Use concealed shims as required to maintain not more than 1/8-inch-in-96-inch variation from a straight, level plane.
 5. Secure backsplashes with adhesive.
 6. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.4 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where impossible to repair, replace countertops. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces.
- C. Protection: Provide kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 12 3623.13

SECTION 123653 - LABORATORY WORKSURFACES

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. Epoxy resin worksurfaces.
 - 2. Setting materials.
- B. Related Sections:
 - 1. Section 064023 "Interior Architectural Woodwork for base cabinets.
 - 2. Section 079200 "Joint Sealants" for joint sealers.
 - 3. Section 220000 "Plumbing" for plumbing fixtures and trim.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. D570 - Standard Test Method for Water Absorption of Plastics.
 - 2. D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
 - 3. D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in edgewise Position.
 - 4. D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
 - 5. D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between 30^o C and 30^o C With a Vitreous Silica Dilatometer.
 - 6. D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
 - 7. D790 - Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 8. D792 - Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - 9. D3801 - Standard Test Method for Measuring the Comparative Burning Characteristics of Solid Plastics in a Vertical Position.
 - 10. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

- B. International Organization for Standardization (ISO) 9001 - Quality Management Systems - Requirements.
- C. NSF International / American National Standards Institute (NSF/ANSI) - 51 - Food Equipment Materials.
- D. Scientific Certification Systems (SCS) - Recycled Content Certifications.
- E. Scientific Equipment and Furniture Association (SEFA) 3 - Work Surfaces.

1.4 SUBMITTALS

A. Submittals for Review:

1. Shop Drawings:

- a. Submit plan, section, elevation and perspective drawings necessary to describe and convey layout, profiles, and product components, including edge conditions, joints, fitting and fixture locations, anchorage, accessories, and finish colors.
- b. Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on Shop Drawings.
- c. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

2. Product Data: Manufacturer's data sheets on each product to be used, including:

- a. Preparation instructions and recommendations.
- b. Storage and handling requirements and recommendations.
- c. Installation methods.

3. Samples:

- a. Selection samples: For each finish product specified, submit complete set of color chips representing manufacturer's full range of standard colors.
- b. Verification samples: For each finish product specified, submit samples representing actual product color; supplied product color and gloss may vary slightly from supplied samples.

B. Quality Control Submittals:

- 1. Test Reports: Certified test reports or recognized evaluation reports showing compliance with specified performance characteristics and physical properties.

C. Closeout Submittals:

1. Maintenance Data:

- a. Provide maintenance, cleaning, and life cycle information.

- b. Include recommended cleaning materials and procedures, and list of materials detrimental to epoxy resin.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Primary products furnished by single manufacturer with minimum 10 years documented experience in work of this Section.
2. Products manufactured in ISO 9001 certified facility.

B. Installer Qualifications: Minimum 5 years documented experience in work of this Section.

C. Mockup:

1. Construct worksurface mockup, 3 feet wide x full depth.
2. Locate where directed.
3. Approved mockup may remain as part of the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Use pallets larger than sheets during transportation.
2. Package materials to prevent damage during shipping and handling.

B. Storage:

1. Store products in enclosed area protected from ultraviolet.
2. Store products in manufacturer's unopened packaging until ready for installation.
3. Store panels using protective dividers to avoid damage to surfaces.
4. For horizontal storage, store sheets on pallets of equal or greater size than sheets with protective layer between pallet and sheet and on top of uppermost sheet.
5. Do not store sheets or fabricated panels vertically.

C. Handling:

1. If protective film is provided, do not remove until panel has been installed.
2. Handle sheets to prevent damage.
3. Remove stickers immediately after installation.

1.7 PROJECT CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's limits.

B. Avoid direct exposure of products to sunlight.

- C. Do not use worksurfaces as bench, ladder, or seating.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product: Provide products from Durcon, Incorporated; Greenstone Classic tops or comparable products approved prior to bidding.

2.2 MATERIALS

- A. Solid Epoxy Resin:

1. Sheets cast from modified epoxy resin and non-asbestos inert fillers with 10 percent of filler certified as post-consumer glass by SCS; compounded mixture cured and thermoset specifically from formulation to provide exceptional physical and chemical resistance required in medium to heavy duty laboratory environments.
2. Sheets monolithic throughout without surface coating application.
3. Certified to NSF/ANSI 51.
4. Certified by GREENGUARD under Indoor Air Quality.
5. Physical properties; minimum acceptable physical performance in accordance with SEFA 3 testing procedures:
 - a. Density/specific gravity: Tested to ASTM D792; minimum test rating of 134.8 PSF or 2.16 gcm.
 - b. Rockwell hardness: Tested to ASTM D785; minimum M scale rating of 110.
 - c. Fire resistance: tested to ASTM D635; classified as self-extinguishing.
 - d. Surface burning characteristics: Tested to ASTM E84; flame spread index 7.4 and smoke develop index of 221.2.
 - e. Surface burning characteristics in vertical position: Tested to ASTM D3801; maximum flame spread index of 7.4 and smoke developed index of 221.2.
 - f. Coefficient of linear thermal expansion: Tested to ASTM D696; rating of 2.46 x 10⁻⁵.
 - g. Heat deflection: Tested to ASTM D648; maximum 205 degrees F or 96 degrees C.
 - h. Flexural strength: Tested to ASTM D790; minimum rating 14.9 KPSI or 103 Mpa.
 - i. Flexural modulus: Tested to ASTM D790; 2,777,501 PSI or 19.2 Gpa.
 - j. Water absorption, 24 hours: tested to ASTM D570; maximum 0.008 percent by weight.
 - k. Compression strength: Tested to ASTM D695; minimum 38.4 kpsi or 265 Mpa.
 - l. Chemical resistance; minimum acceptable chemical resistance performance in accordance with SEFA 3:

REAGENT TESTED	METHOD	RATING
Amyl Acetate	A	0
Ethyl Acetate	A	0
Acetic Acid, 98%	B	0
Acetone	A	1
Acid Dichromate, 5%	B	0
Butyl Alcohol	A	0

Ethyl Alcohol	A	0
Methyl Alcohol	A	1
Ammonium Hydroxide, 28%	B	0
Benzene	A	1
Carbon Tetrachloride	A	0
Chloroform	A	1
Chromic Acid , 60%	B	0
Cresol	A	0
Dichloroacetic Acid	A	0
Dimethyl formamide	A	0
Dioxane	A	0
Ethyl Ether	A	0
Formaldehyde, 37%	A	0
Formic Acid, 90%	B	0
Furfural	A	1
Gasoline	A	0
Hydrochloric Acid, 37%	B	0
Hydrofluoric Acid 48%	B	0
Hydrogen Peroxide, 28%	B	0
Tincture of Iodine	B	0
Methyl Ethyl Ketone	A	0
Methylene Chloride	A	0
Monochlorobenzene	A	0
Naphthalene	A	0
Nitric Acid , 20%	B	0
Nitric Acid, 30%	B	1
Nitric Acid, 70%	B	1
Phenol, 90%	A	0
Phosphoric Acid, 85%	B	1
Silver Nitrate, Saturated	B	0
Sodium Hydroxide, 10%	B	1
Sodium Hydroxide, 20%	B	1
Sodium Hydroxide, 40%	B	1
Sodium Hydroxide, Flake	B	1
Sodium Sulfide, Saturated	B	2
Sulfuric Acid, 25%	B	1
Sulfuric Acid, 85%	B	2
Sulfuric Acid, 96%	B	3
Sulfuric Acid, 85% & Nitric Acid , 70%, Equal Parts	B	3
Toluene	A	1
Trichloroethylene	A	0
Xylene	A	0
Zinc Chloride, Saturated	B	0

Testing Method Descriptions:

Method A - Volatile chemicals (organic solvents): Cotton ball saturated with test reagent is placed in one-ounce bottle (20 x 75mm test tube or similar container) with reservoir of liquid above ball.

Container is inverted on test material for period of 24 hours at standard temperature 23 degrees C plus or minus 2 degrees C (73 degrees F plus or minus 4 degrees F).

Method B - Non Volatile Chemicals: Five drops (1/4 cc) of test reagent are placed on test material surface. Reagent is then covered with watch glass (25 mm) for period of no less than 24 hours at standard temperature of 23 degrees C plus or minus 2 degrees C (73 degrees F plus or minus 4 degrees F).

Result Definitions:

0 - No Effect: No detectable change in material surface.

1 - Good: Slight detectable change in color or gloss but no change to function or life of work surface material.

2 - Fair: Slight surface etching or severe staining. Clearly discernable change in color or gloss but no significant impairment of surface life or function.

3 - Poor: Pitting, cratering or erosion of work surface material; obvious and significant deterioration. Objectionable change in appearance due to surface discoloration.

6. Color: Black Onyx.

2.3 ACCESSORIES

- A. Installation Materials: Manufacturer's joint adhesive, panel adhesive, and sealants as required to suit project conditions.

2.4 FABRICATION

- A. Fabricated tops and accessories in accordance with manufacturer's recommendations, approved Shop Drawings, and SEFA 3.

- B. Epoxy Resin Worksurfaces:

1. Thickness:

a. 1 inch unless otherwise indicated.

b. Check each sheet at factory for required thickness.

c. Maximum variation in thickness: plus or minus 1/16 inch from corner to corner.

2. Warpage:

a. Inspect tops for warpage prior to fabrication by placing on true flat surface.

b. Maximum allowable warpage: 1/16 inch in 36 inch span or 3/16 inch in 96 inch span.

3. Fabrication:

a. Shop fabricate in longest practical lengths.

b. Bond joints with highly chemical resistant cement with properties and color similar to base material.

- c. Provide 1/8 inch drip groove at underside of exposed edges, set back 1/2 inch from face.
 - d. Finish exposed edges.
- 4. Fabricate tops flat.
- 5. Edge treatment: Standard 1/8 inch chamfered edge.
- 6. Corner treatment: exposed corners shall be eased slightly for safety.
- 7. Back and end splashes:
 - a. Supplied loose for field installation.
 - b. Same material and thickness as worksurfaces.
 - c. 4 inches high unless otherwise indicated.
- 8. Top-mounted end splash where worksurfaces abut adjacent construction at and locations indicated on Drawings.
- 9. Joints: Maximum 1/8 inch, bonded with epoxy grout.
- 10. Make joints between two benches level.
- 11. Locate joints away from sinks and over or near supports.
- 12. Allowable tolerances:
 - a. Square: Plus or minus 1/64 inch for each 12 inches of length.
- 13. Location of cutouts and drilled openings: Plus or minus 1/8 inch of design dimension.
 - a. Size of cutouts and drilled openings: Plus 1/8 inch or minus 0 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until cabinets have been installed.
- B. Confirm that surfaces to receive tops are plumb and level, with maximum deflection of 1/4 inch in 20 feet.

3.2 PREPARATION

- A. Clean surfaces just prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Install tops plumb and level.

- C. Scribe to adjacent surfaces in accordance with manufacturer's recommendations.
- D. Fasten tops to supporting construction with adhesives appropriate for use with adjoining construction and as recommended by manufacturer.
- E. Form field joints using manufacturer's recommended adhesive. Form joints to be inconspicuous and nonporous.

3.4 PROTECTION

- A. Protect installed products until completion of Project.
- B. Touch up, repair, or replace damaged products.

END OF SECTION 123653

SECTION 123661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

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. Quartz agglomerate countertops.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
- C. Shop Drawings: For countertops. Show materials, finishes, edge profiles, methods of joining, and cutouts for plumbing fixtures.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- D. Samples for Initial Selection: For each type of material exposed to view.
- E. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches square.
 - 2. One full-size quartz agglomerate countertop, with front edge, 8 by 10 inches, of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For composite wood and agrifiber products; solid surfacing materials; and adhesives.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For quartz agglomerate countertops 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.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.
- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
 - 1. Build mockup of typical countertop as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where countertops 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.

1.8 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS – **QT1**

- A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Cambria; Quartz or comparable product by one of the following:
 - a. Cosentino North America; C&C North America, Inc.
 - b. Lotte Chemical Co., LTD.
 - c. Meganite Inc.
 - d. Wilsonart LLC.
1. Colors and Patterns: As selected by Architect from manufacturer's full range.

- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 1. Grade: Premium.
- B. Configuration:
 1. Front: Straight, slightly eased at top.
- C. Countertops: 1-inch thick, quartz agglomerate with front edge built up with same material.
- D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- E. Joints: Fabricate countertops without joints, except where counters exceed product lengths, in which case located joints as directed by Architect and confirmed on shop drawings.
 1. Joint Type: Bonded, 1/32 inch or less in width.
 2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.
- F. Cutouts and Holes:
 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by quartz agglomerate manufacturer.
 1. Verify adhesives have a VOC content of 70 g/L or less.

- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. 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.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- E. Install aprons to backing and countertops with adhesive and with screws through metal supports. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- F. 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.
 - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.19

SECTION 133123 – TENSILE FABRIC STRUCTURES

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. Section includes a tensioned fabric canopy system as shown on Drawings and specified in this Section.
- 2. Architect's drawings indicate design intent with respect to sizes, shapes, and configurations of the tensioned fabric canopy. Provide all components and accessories required for complete tensioned fabric canopy system, whether or not specifically shown or specified.
- 3. The tensioned fabric structure will assume bolted/pinned connections for field assembly. No field welding will be permitted.

- B. The tensioned fabric structure Subcontractor shall be responsible for the structural design, detailing, fabrication, supply, and installation of the Work specified herein. The intent of this specification is to establish in the first instance an undivided, single-source responsibility of the Subcontractor for all of the foregoing functions.

- C. All element sizes, material strengths, forces and quantities shown on the contract documents are to be taken as a developed concept. Final structural analysis and design are the responsibility of the subcontractor. The subcontractor is responsible at the time of bid to determine any additional costs related to their design and member sizing for the fabric roof.

- D. Subcontractor's Work shall include the structural design, supply, fabrication, shipment, and erection of the following items:

- 1. The architectural membrane as indicated on the drawings and in these specifications.
- 2. Cables and fittings.
- 3. Perimeter, catenary, and sectionalized aluminum clamping system.
- 4. Structural steel, including masts, trusses, struts, and beams as indicated on the drawings.
- 5. Fasteners and gasketing.

- E. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for concrete footings for posts of tensioned fabric structure.
- 2. Section 051000 "Structural Steel Framing" for steel structure supporting tensioned fabric structure.
- 3. Section 312000 "Earth Moving" for preparation, compaction, and grading of granular base.

1.3 REFERENCES

A. Definitions:

1. Tensioned Fabric Structure: Cable and/or frame supported tensioned membrane-covered fabric structure; incorporating a fabric with low elongation characteristics under tension and capable of an anticlastic configuration. Fabric structures in which fabric is applied as flat or mono-axially curved configurations are not acceptable.

1.4 PERFORMANCE REQUIREMENTS:

A. Reference Standards: Except as otherwise shown or noted, all work shall comply with the requirements of the following codes and standards:

1. American Institute of Steel Construction (AISC).
 - a. Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.
 - b. Code of Standard Practice for Steel Buildings and Bridges.
 - c. Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design.
 - d. Specification for Allowable Stress Design of Single-angle Members.
 - e. Seismic Provisions for Structural Steel Buildings.
2. American Society of Civil Engineers.
 - a. ASCE 19: Structural Applications of Steel Cables for Buildings.
3. American Society of Testing and Materials (ASTM).
 - a. ASTM A586: Standard Specifications for Zinc-Coated Steel Structural Strand.
 - b. ASTM A603: Standard Specifications for Zinc-Coated Steel Structural Wire Rope.
 - c. ASTM D4851-88: Standard Test Methods for Coated and Laminated Fabrics for Architectural Use.
 - d. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
 - e. ASTM E108: Standard Test Methods for Fire Test and Roof Coverings.
 - f. ASTM E136: Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.
 - g. ASTM C423: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - h. ASTM E424: Standard Test Method for Solar Energy Transmittance and Reflectance of Sheet Materials.
4. American Welding Society (AWS).
 - a. AWS D1.1: Structural Welding Code.
 - b. AWS 2.4: Symbols for Welding and Nondestructive Testing.
5. Aluminum Association
 - a. Specifications for Aluminum Structures.
6. National Fire Protection Association (NFPA).
 - a. NFPA 701: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
7. Steel Structures Painting Council (SSPC).
 - a. Steel Structures Painting Manual, Volumes 1 and 2.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at project site at time to be determined by Architect. Review methods and procedures related to installation including, but not limited to, the following:
1. Inspect and discuss existing conditions and preparatory work performed under other contracts.
 2. In addition to the Contractor and the installer, arrange for the attendance of installers affected by the Work, The Owner's representative, and the Architect.

1.6 ACTION SUBMITTALS

- A. Substitutions: Other products are acceptable if in compliance with all requirements of these specifications. Submit alternate products to Architect for approval prior to bidding in accordance Product Substitution Procedures.
1. Provide substantiation that proposed system does not violate any other manufacturer's patents, patents allowed or patents pending.
 2. Provide a sample copy of insured, non-prorated warranty and insurance policy information.
- B. Product Data: For each type of product.
1. Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, and finishes for tensioned fabric structures.
 2. Include rated capacities, light transmissions, and operating characteristics of furnished specialties and accessories.
- C. Design Drawings:
1. Include plans, elevations, sections, mounting heights, and frame assembly details.
 2. Preliminary member sizes with wall thickness TBD.
 3. Preliminary footing layout and foundation design with final depth TBD.
 4. Show intended fabric attachment hardware and details.
 5. Identify direction, details and locations of fabric seams.
 6. Show details of fabric membrane dimensions including length of spans, sag in curvature and actual shaded area.
- D. Engineered Drawings (submit after Design Drawings have been approved):
1. Calculations with Wet Stamp seal of a Professional Engineer with a license in the same state as the project location.
 2. Engineering Drawings with Wet Stamp seal of a Professional Engineer with a license in the same state as the project location.
 3. Include plans, elevations, sections, mounting heights, and frame assembly details.
 4. Provide frame member sizes and required wall thicknesses.
 5. Identify all welding requirements.
 6. Detail all bolted and/or pin connections for frame assembly.
 7. Identify required sizes of bolts, pins, plates and tubing.
 8. Verify the fabric meets minimum engineering requirements.
 9. Detail fabric attachment methods and identify thickness of all membrane plates, clamps and other attachment components.

10. Call out all cable sizes and pretension requirements.
11. Submit anchor-bolt plans before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach the tensioned fabric structures to foundation. Indicate column reactions at each location.

E. Samples for Initial Selection: Electronic file of available frame finish colors.

F. Samples for Verification: For the following:

1. Fabric: Qty. (3) 8 ½" x 11" samples of fabric as selected by the architect.
2. Frame Finish: Qty. (3) Sample chips, not less than 2" x 3" in size.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator and professional engineer.

B. Welding certificates.

C. Sample Warranty: For fabric warranty.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tensioned fabric structures to include in operation and maintenance manuals.

1. Include the following:
 - a. Methods for maintaining tensioned fabric structure fabrics and finishes.
 - b. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.

1.9 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate tensioned fabric structures similar to those required for this Project and whose products have a record of successful in-service performance.

1. Fabricator is a Master Fabric Craftsman certified by the Industrial Fabrics Association International.
2. Fabricator's responsibilities include fabricating and installing tensioned fabric structures and providing professional engineering services needed to assume engineering responsibility.
3. Fabricator's engineering services must utilize Finite Element Analysis software that performs fabric form finding and takes into account fabric material properties and pre-stress characteristics.
4. Fabricator must have proven record of at least (5) successful projects of similar size and similar specified fabric material.
5. Fabricator must have been in continuous operation as a professional tensioned fabric structure manufacturer for minimum of (10) years prior to contract.
6. Fabricator must have an in-house Made-in-America manufacturing facility for both frame and fabric membrane components.

- B. Installer Qualifications: Fabricator of products.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of tensioned fabric structure in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Where tensioned fabric structure installation is indicated to fit to other work, verify dimensions of other work by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for fenestration operation throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.11 WARRANTY

- A. Special Warranty: Manufacturer and fabricator agree to repair or replace components of tensioned fabric structures that fail in materials or workmanship within specified warranty period of one year from the date of Substantial Completion.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including framework.
 - b. Deterioration of fabric including seam failure.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period, Fabric: Reference the manufacturer's limited warranty for the specified fabric manufacturer and product.
 - 3. Warranty Period, Cables, Securement Devices and Accessories: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with requirements, provide the tensioned fabric structures designed, engineered, fabricated, and installed by the following:
 - 1. Wicked Shade, Inc.
(801) – 942-1835
www.wickedshade.com
 - 2. Or approved equal. Manufacturer must meet all minimum requirements as outlined in item 1.9 QUALITY ASSURANCE of this section and show written proof for each item listed to become an approved equal.
 - 3. Substitution requests must be submitted by a Prime Bidder, minimum of (10) days prior to bid date. Any approved equals shall be issued by addendum only, prior to the bid date.

4. Applicant for approve equal must submit engineering analysis along with pricing. Analysis must include:
 - a. Finite Element Analysis under various load cases
 - b. Fabric form finding of membrane
 - c. Adequate membrane gradient under load displacement to allow water runoff
 - d. Frame member and cable sizing
 - e. Footing reaction loads

- B. Source Limitations: Obtain tensioned fabric structures from single source from single manufacturer.

2.2 DESCRIPTION

- A. General: Provide a tensioned fabric structure system that complies with requirements specified herein by testing the Subcontractor's corresponding membrane system in accordance with the indicated test methods.
- B. Regulatory Requirements: Provide tensioned fabric canopy system complying with requirements and limitations of authorities having jurisdiction that are within Contractor's control.
 1. Building Code Criteria: The tensioned fabric structure shall comply with the International Building Code, 2021 edition.
 2. Comply with local building codes and respective loading criteria for Snow Loads, Live Loads, Dead Loads, Wind Speed, and Seismic Loads.
 3. Life Safety: Tensioned fabric structure shall be detailed so that no life safety issue is created in the event of a loss of a part of the membrane. The tensioned fabric structure shall not rely on the membrane for structural stability.

2.3 PERFORMANCE / DESIGN CRITERIA

- A. Delegated Design: Engage a qualified professional engineer to design tensioned fabric canopy system. Delegated design engineering requirements include, but are not limited to, the following:
 1. Prepare structural design drawings defining the precise interface geometry determination, reaction loads imposed on structural steel framing, anchoring loads, connection details, interfaces and seam layouts.
 2. Structural calculations for the tensioned fabric canopy system shall include:
 - a. Large deflection numerical shape generation that will insure a stable, uniformly stressed, three dimensionally curved shape that is in static equilibrium with the internal pre-stress forces and is suitable to resist all applied loads.
 - b. Large deflection finite element method structural analysis of the membrane system under all applicable wind and seismic loads.
 - c. Connection design including bolt, weld and ancillary member sizing.
 - d. Biaxial fabric test specification, interpretation and fabric compensation determination.
 - e. Accurate generation of the two dimensional compensated fabric templates required to generate the three dimensional equilibrium shape.
- B. In engineering tensioned fabric canopy system fittings and accessories to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.
 2. Stainless Steel: 60 percent of minimum yield strength.
 3. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
- C. Structural Performance: Tensioned fabric canopy system shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
1. Wind Loads: To be determined by Subcontractor's Engineer of Record.
 2. Live Loads: To be determined by Subcontractor's Engineer of Record.
 3. Snow Loads: To be determined by Subcontractor's Engineer of Record.
 4. Seismic Loads: To be determined by Subcontractor's Engineer of Record.
- D. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 2. Copper Alloys: 60 percent of minimum yield strength.
 3. Stainless Steel: 60 percent of minimum yield strength.
 4. Steel: 72 percent of minimum yield strength.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 degree F, ambient; 180 degree F, material surfaces.
- F. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.4 CANOPY FABRIC MATERIALS

- A. Product: Subject to compliance with requirements, provide fabric as called out and specified by the Architect in the bid drawings.
- B. Fire-Test-Response Characteristics: Provide canopy fabric with the fire-test-response characteristics indicated, as determined by testing identical products according to test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Flame-Resistance Ratings: Passes NFPA 701.
- C. PTFE Fabric manufacturer: The following is a list of approved PTFE fabric manufacturers for tensioned fabric structures. Reference architectural drawings for fabric call out.
1. Saint Gobain (Sheerfill product line)
 2. SEFAR (Tenara product line)
 3. Verseidag (Duraskin product line)
 4. Chukoh (Skytop product line)
 5. Taconic (Solus product line)

- D. PVC Fabric manufacturer: The following is a list of approved PVC coated Polyester fabric manufacturers for tensioned fabric structures. Reference drawings for fabric call out.
1. Ferrari Textiles (Preconstraint product line)
 2. Seaman Corporation (Shelter-Rite product line)
 3. Naizil
 4. Hiraoka
 5. Mehler (Polymer product line)
- E. Fabric properties:
1. Fabric thickness and tensile strength: Must meet engineering requirements with a safety factor of five.
 2. Color: To be selected from the manufacturer's range of available colors.
- F. Fabric Substitutions
1. High Density Polyethylene (HDPE) woven mesh fabric may be substituted for non-waterproof applications only. HDPE fabric substitutions are only allowed when the architectural drawings specifically call out fabric as "Shade Fabric" or "HDPE Fabric" or "Non-waterproof Fabric" or "Fabric Mesh".
 2. Acceptable manufacturers of HDPE fabrics are Polyfab, Synthesis and Monotec 370.
 3. Color: To be selected from the manufacturer's range of available colors.
 4. HDPE fabric membranes shall be designed to avoid contact with any PVC material.
 5. Fabric shall be sewn with PTFE thread to avoid premature failure due to UV deterioration.
 6. Membrane shall be sewn with a chain stitch to prevent bursting at the seams.

2.5 CANOPY FRAME, CABLES, FITTINGS AND ACCESSORIES

- A. General: Provide accessories as standard with tensioned fabric canopy system fabricator and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
- B. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- C. Frame material shall be shall be constructed of cold rolled carbon steel unless otherwise specified by the architect in the bid drawings.
- D. Steel and Iron:
1. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
 2. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
 3. Plates, Shapes, and Bars: ASTM A 36 or ASTM A 572 per engineering requirements.
- E. Stainless Steel (when applicable);
1. Tubing: ASTM A 554, Grade MT 316L.
 2. Pipe: ASTM A 312/A 312M, Grade TP 316L.
 3. Castings: ASTM A 743/A 743M, Grade CF 8M or CF 3M.
 4. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 316L.
 5. Bars and Shapes: ASTM A 276, Type 316L.

- F. Aluminum (when applicable):
1. Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
 2. Extruded Bars and Shapes: ASTM B 221, Alloy 6063-T5/T52.
- G. Cables and Fittings shall be constructed of galvanized steel unless otherwise specified by the architect in the bid drawings:
1. All cables in contact with PTFE fabric shall be PVC coated.
 2. Any cable in contact with HDPE fabric shall never have PVC coating.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - a. John A. Batchelor Co Inc.
 - b. Jack Rueben and Sons.
 - c. McMaster Carr
 - d. Frontier Technologies.
 - e. The Crosby Group.
 - f. Ronstan International Inc.
 4. Galvanized Cables:
 - a. Cable: 7-by-19 galvanized steel structural wire rope made from wire complying with ASTM A 603.
 - b. Cable Fittings: Connectors of types indicated or required, fabricated from hot dip galvanized steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
 5. Stainless Steel Cables:
 - a. Cable: 7-by-19 wire rope made from wire complying with ASTM A 492, Type 316.
 - b. Cable Fittings: Connectors of types indicated or required, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
- H. Metal Battens for Securing Canopy Fabric to Structural Steel Frame: Extruded aluminum.

2.6 CANOPY FRAME FINISH

- A. Frame Finish shall be polyester powder painted unless otherwise specified by the architect in the bid drawings.
1. Powder Coat Finish:
 - a. Commercial blast clean surface in accordance to SSPC-SP 10.
 - b. Apply primer and polyester powder coat paint to a minimum of 3 mils thick.
 - c. Color: As selected from manufacturer's available stock colors.
 2. Three Part Paint Finish for corrosive environments:
 - a. Commercial blast clean surface in accordance to SSPC-SP 10.
 - b. Primer Material properties – (1) coat of PPG/Ameron's Dimecoat 9 at 2.5- 4.0 mils MDFT.
 - c. Paint Material properties – (1) coat of PPG/Ameron's Amerlock 2 at 3.0-7.0 mil MDFT per coat.
 - d. Paint Material properties – (1) coat of PPG/Ameron's PSX 700 at 3.0-7.0 mil MDFT per coat.
 - e. Minimum thickness – 8.5-18 mils TDFT.
 - f. Color: As selected from manufacturer's available stock colors.
 - g. 10 year warranty for gloss and color retention.

3. Galvanizing (only if architect indicates requirement on bid drawings):
 - a. Comply with ASTM A 123/A 123M or ASTM A 153/A 153M for hot-dip galvanizing, as applicable.
 - b. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine structural steel framing and other substrates, 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.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Proceed with installation of tensioned fabric structure only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations.
- B. Erect frame and fabric in accordance with the procedures of the approved manufacturer.
- C. Adequate pre-stress shall be applied to eliminate fabric wrinkles and excess cable sag.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Prepare test and inspection reports.

3.4 MEMBRANE PATCHING

- A. Any and all patching must be done by trained and authorized personnel.
- B. Minor repairs are defined as:
 1. A patch, no larger than 1% of the area of the fabric panel.
 2. Sewn or sealed reinforcement at corners or joints, sewing and sealing no greater than 12 inches in length.
- C. A maximum of one patch per membrane will be permissible.
- D. No more than two patches will be allowed for the entire project.
- E. Sewn or sealed reinforcement is allowed at all corners when necessary.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to one visit to Project during other-than-normal occupancy hours for this purpose.

3.6 CLOSEOUT ACTIVITIES

- A. Demonstration: Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust cable and fabric tension and to clean and maintain canopy fabric.

END OF SECTION 133123

SECTION 21 0000 - FIRE PROTECTION

PART 1 – GENERAL

1.1 GENERAL CONDITIONS

- A. The requirements of Section 220000, 230000, 230100, 230501, 230800, 230900, and 251000 shall govern the work in Section 210000, where applicable, and where not in conflict with governing codes and ordinances. Division 1 is a part of this and all other sections of these specifications.

1.2 SCOPE

- A. The work required includes the designing, hydraulically calculating pipe sizes, flows, and pressure, furnishing and installation of fire protection systems in accordance with the drawings, specifications, latest standards and codes for complete systems for the building.
- B. The work specified in this section shall be installed by none other than an approved fire sprinkler contractor. All fire protection system piping shall be hydraulically calculated. All systems shall be subject to the inspection and approval of the local fire authority or his representative for compliance of applicable standards.
- C. **Preferred contractors shall be Kimco Fire Protection, Chaparral Fire Protection, Fire Engineering Co., Paradise Fire Protection Inc. Delta Fire Protection Systems, Fire Services Inc., State Fire DC, Preferred Fire Protection and Firetrol Protection Systems.**
- D. All work shall be coordinated with other subcontractors.
- E. The sprinkler system shall consist of the required number of sprinkler heads, piping, hangers, drains, test pipes, alarms, valves, gauges, fire department connections, anti-freeze loop, and all other parts to assure a complete system to meet the requirements of the owner's insurance underwriter, local authority having jurisdiction, and in accordance with nationally recognized standards.
- F. Codes & Standards:
 - 1. Water Supply: National Fire Code #24 - 2021 International Building Code.
 - 2. Wet Sprinkler System & Combined Systems: N.F.C. #13 and #14 - I.B.C.
 - 3. Alarm Equipment: N.F.C. #70 & 72A
 - 4. Standpipe & Hose Systems: N.F.C. #14 - I.B.C.
 - 5. Supervision: N.F.C. #13 and #14 - I.B.C.
 - 6. Temporary Fire Protection: N.F.C. #14 - I.B.C.
 - 7. Sprinkler Heads: N.F.C. #13
 - 8. Sleeves and Location: N.F.C. #13
 - 9. Excavation and Backfill: 230900 of this specification

G. Work Included Elsewhere:

1. Fire Hydrants - By Site Utilities Contractor
2. Underground Mains: N.F.C. #24
3. Concrete Work - By General Contractor
4. Access Doors - By General Contractor.
5. Painting of sprinkler piping - By Painting Contractor.
6. Color coding or pipe identification - By Mechanical Contractor.
7. Wiring of flow switches and gate valve supervisory switches - By Electrical Contractor.

1.3 WORK BY FIRE PROTECTION CONTRACTOR

- A. This contractor shall furnish and install all labor, material, and equipment to make a complete and working fire protection system fully tested and approved in accordance with the drawings, standards of this specification for the new building.

1.4 WATER SUPPLY

- A. Fire protection contractor shall perform a flow test at or near site prior to final calculations for system. Flow test to be performed in the presence of local fire marshal and Jordan School District representative.
- B. Connect fire sprinkler mains to connections provided by others as shown on the drawings and install U.L. labeled pipes into building at locations shown. Coordinate testing and flushing of this portion of the main in accordance with N.F.C. #24 and furnish test certificates to the Owner's representative.
- C. This contractor will be responsible for coordinating with the site utilities contractor to assure that the underground water supply has been flushed and tested in accordance with NFPA pamphlet #24 prior to the connection of the overhead sprinkler system.

D. Flow Test Information:

Date:	7-8-2024
Location:	3706 West 9800 South South Jordan, Utah
Static Pressure:	101 PSI
Residual Pressure:	81 PSI
Flow Rate:	2734 GPM
Available Flow at 20 psi:	4585 GPM

E. Sprinkler System:

1. This system shall conform to N.F.C. #13 and #14 and I.B.C. Existing riser to be re-used. Sprinkler systems are to be light, ordinary, or extra hazard, as required by NFC-13 and the Utah State Fire Marshall's office.
2. System shall be hydraulically calculated. Sprinkler system shall be light hazard, except for casual ordinary and extra hazard group 1 in storage and service areas. Density for light hazard areas shall be 0.10 gpm per sq. ft. over 1500 sq. ft. Remote area with a maximum head spacing of 225 sq. ft. Service area shall be density of 0.15 over 2000 sq. ft. with maximum spacing of 130 sq. ft.

1.5 QUALIFICATION OF DESIGNER

- A. Designer shall be an engineering technician or Senior Engineering Technician (Level III or Level IV), NICET certification for fire sprinkler system design.

1.6 QUALIFICATION OF INSTALLER

- A. It is intended that the system be designed and installed by a firm regularly engaged in the design and installation business of Fire Sprinkler contracting. The Owner's representative may require evidence to support the ability of the contractor to perform work in the scope and volume as specified. A contractor who cannot verify such experience, may be found not suitable to perform the work.

PART 2 – PRODUCTS

2.1 HANGERS

- A. All hangers to be in accordance with NFPA Pamphlet No. 13.

2.2 RISERS (Existing to be reused)

- A. Risers shall be at the locations shown and shall include a U.L. approved control valve, double check valve, flow switch, pressure gauges, water motor gong, or electric bell, standard fire department connection, gate valve supervisory switch, test connections, and drains as required.
- B. Existing fire department connection shall be updated to a duplex type with locking Knox caps per JSD standards and local Fire Authority requirements.

2.3 SPRINKLER HEADS

- A. Sprinkler heads shall be U.L. approved. "K" factors shall be the same on each system and/or floor. See plans for head types. Extended coverage heads will be allowed per NFPA.
- B. Sprinklers shall be of the proper temperature rating. Location of sprinkler head wherever reasonably possible shall be symmetrical and coordinated with the ceiling pattern.
- C. Number and location of sprinkler heads shown on the drawings are schematic. Exact number and location of heads shall be determined by the system design, and architectural coordination.
- D. Provide dry pendent heads in areas subject to freezing, only where wet piping can be run in heated space. Otherwise, provide antifreeze loops.
- E. Provide spare head cabinets in accordance with NFPA No. 13 and equip same with at least ten (10) concealed type heads, three (3) upright white heads, six (6) upright brass heads, and appropriate wrenches.
- F. Provide head guards in all areas where heads are subject to physical abuse.

2.4 VALVES

- A. All valves and fittings shall be listed by Underwriters Laboratories or approved by Factory Mutual for fire protection duty and shall be installed in accordance with their listing and/or approval. Control valve shall have alarm supervisory switches with two sets of contacts and normally open/normally closed.
- B. All indicating valves will be of the listed and/or approved type with an electric tamper switch approved for use with that valve.
- C. Water hammer arrestors shall be provided ahead of all automatic valves to eliminate water hammer and shall be installed vertically in an accessible location.
- D. Hose valves off standpipes shall be U.L. approved. All valves shall be 2-1/2" with 2-1/2" X 1-1/2" reducer and cap with chains. Valves shall be polished brass and chrome plated.

2.5 PIPING

- A. All piping above ground shall be Schedule 40 domestic steel pipe and fittings.
- B. All fire sprinkler piping shall be schedule 40 black steel. All piping and fittings shall be U.S. manufacture. Thin wall and schedule 40 equivalent piping will not be allowed.

2.6 PIPING SUPPORT

- A. Steel roof deck shall not be used to support loads from fire piping or equipment of any kind, unless specifically noted otherwise.
- B. Bracing of miscellaneous items (fire, mechanical, electrical, plumbing, etc.) to the bottom chord of joists or girders will not be allowed in any instance. All lateral braces must connect to the top flange/top chord of the framing member above unless noted otherwise on the structural drawing.
- C. It is essential that all piping be supported from roof structure at joist within 6" of panel point location and from top or bottom chord of floor or roof joist.
- D. Beam clamps shall not be used to hang piping from open web joist, trusses or girders.
- E. Use of beam clamps at structural joist systems are not allowed. See detail 3/M503.

2.7 EARTHQUAKE BRACING

- A. Install earthquake bracing in accordance with NFPA #13 Standards and Utah State Fire Marshall's Office.

2.8 SLEEVES

- A. Sleeves shall be furnished, together with their location and elevations to the construction manager, timely with required schedule or concrete pours. If sleeves are missed by this contractor, he shall be responsible for core drilling thru concrete at his own expense, and he shall be responsible for his cutting and patching. Sleeves shall be of the size, type, and length required by N.F.P.A. codes. See Section 230900 for "Sleeves".
- B. Sleeves shall be placed in structural members only where approved by the Owner's representative.

- C. Sleeves through foundation walls below grade shall be mechanical seal type with watertight sealing grommets and pressure rings. Sealing grommets shall be non-melting at temperatures incurred. Foundation wall sleeves shall be "O.Z. Type WSK".
- D. Sleeves thru Finished Surfaces:
For pipes passing thru finished partitions or ceilings, provide galvanized sheet iron sleeves of suitable size. The sleeves shall be fastened to construction to prevent creep along pipe and the sleeve ends shall be flush with finished surfaces. Provide escutcheon plates at each side of finish wall or floor or ceiling for all pipes passing thru same.
 - 1. Sleeves thru Fire-rated Surfaces:
All pipe sleeves and ductwork penetrating fire walls and surfaces shall be packed inside after pipes have been placed with a U.L. listed fire safing system. Contractor shall submit to the Owner's representative for review and approval specific installation diagrams showing exact method(s) to be used.
 - 2. Sleeves thru Sound Rated Surfaces:
All pipe sleeves and ductwork penetrating sound rated walls or surfaces shall be packed with dense fiberglass, sealed with duct sealer and fitted with metal cover flanges on both sides.
 - 3. Sleeves thru Floors:
Sleeves thru floors above grade shall extend 1" above the floor and shall be sealed watertight with waterproof silicone caulking.
- E. All penetrations must be sleeved or core drilled/cut. Hammer drill is not an acceptable means.

PART 3 – EXECUTION

3.1 TEMPORARY FIRE PROTECTION DURING COURSE OF CONSTRUCTION

- A. This contractor shall provide fire protection as required by N.F.C. #14 - Chapter 8 and shall be coordinated with the local fire department.

3.2 SHOP DRAWINGS

- A. Shop drawings, submittals, and hydraulic calculations, as necessary and required, shall be submitted to the Owner's representative for approval prior to incorporating materials or equipment into the work. Shop drawings shall be complete and in accordance with N.F.C. #13, #14, #20, and all applicable standards, submittals, and equipment, valves, flow switches, controls, and other important items shall be complete, showing details, description, and characteristics; hydraulic calculations shall be based on the water system fire flow capacities shown on the drawings and shall show flows, pressures, velocities, pipe size, and equivalent lengths as required for the system.
- B. Calculations shall be arranged in an orderly manner with sufficient reference points for the approving authority to review and approve.
- C. Testing shall be accomplished by this contractor for all required systems, equipment, and appurtenances, as required by the various standards and codes. The Owner's representative shall witness and sign off each item required. This contractor shall furnish required forms.

3.3 TESTS

- A. Install all test pipes and valves as required by NFPA No. 13. Locate inspector's test valves and auxiliary drain valves above ceilings in areas approved by the Architect and provide hose bibb connections. Conduct all tests as required by NFPA Standards and Insurance Services Office and submit copies of completed test forms to the building owner.
- B. All fire sprinkler related tests requiring the witnessing by local authorities will be the responsibility of this contractor. If tests are not run or do not have the proper witness or documentation, then they will be run late and all damage caused by the system, or caused in uncovering the system for such tests will be borne by this contractor.
- C. The Utah State Fire Marshall and building owner shall be notified (in writing) at least three days in advance of the following:
 - 1. Hydrostatic test and final inspection of the underground, prior to backfilling.
 - 2. Flushing of underground prior to connection to overhead.
 - 3. Hydrostatic test and final inspection of overhead, prior to the installation of the ceilings.

3.4 GENERAL REQUIREMENTS

- A. This contractor shall submit complete drawings, hydraulic calculations, and proper documentation to the local authority having jurisdiction and receive their approval before submitting such material to the Owner's representative for final approval. The contractor will be required to show proof of submittal to the Owner's insurance underwriter and local building authorities before installation may begin.
- B. All work of this contractor will be coordinated with other trades to insure minimal changes to the sprinkler system from the designs. Careful coordination of mechanical and electrical ducts, pipe and conduit shall be required. The ceiling cavity must be carefully reviewed and coordinated with all trades. In the event of conflict, the installation of the mechanical equipment and piping shall be in the following order: plumbing waste, rainwater, and soil lines' supply, return, and exhaust ductwork; water piping; fire protection piping; and pneumatic control piping.
- C. Every effort shall be required to ensure that the heads form a symmetrical pattern in the ceiling with the ceiling grid, the lights, and diffusers and grilles and as shown on the Architect's reflected ceiling plan. Offsets shall be made in piping to accommodate ductwork in ceiling. Heads should be symmetrical, and all piping run parallel or perpendicular to building lines. In no case shall sprinkler heads be installed closer than 6" from ceiling grids or closer than approved distances from ceiling obstructions.
- D. All sprinkler piping shall be run concealed unless approved by the Owner's representative. All lines will be run as high as possible so as to not interfere with future changes to ceiling heights or other mechanical equipment. This contractor will be responsible for all sleeves, core drills, and sealing of penetrations in walls, floors, and structural members to facilitate the installation of the system, however, no holes in, or attachments to structural members will be allowed unless approved by the Owner's representative.
- E. All required drains and test pipes will be installed and finished in a workmanlike manner, terminating at a proper location to accommodate the required outflow without damaging the building or landscaping. Drain and test pipe locations shall be approved by the owner's representative.

- F. All piping, and heads located in un-heated spaces shall be installed with a glycol loop system. Coordinate location with the owner's representative. Indicating valves with tamper switches shall be installed and wired as required by code. Coordinate with electrical contractor.
- G. No piping or valve assemblies shall be run exposed in a finished area without the prior approval of the owner's representative.
- H. **All heads located in specialty ceiling systems shall be coordinated with Architect prior to any installation.**
- I. **All heads located in ceiling clouds systems shall be piped rigid no flex hoses are allowed in exposed areas.**

3.5 JOB CLOSEOUT

- A. This contractor shall assure that all placards, signs, and instruction manuals are in place, and all tests are run before any consideration for final payment will be considered. This includes maintenance manuals, hydraulic calculations placards, spare head cabinets and the proper number of spare heads, and instruction to on-site personnel.
- B. This contractor shall, in addition to the above, furnish the owner one reproducible document of the sprinkler system "record drawings" for his project files.

3.6 WATER SUPPLY ANALYSIS & FIRE FLOW INFORMATION (BEGINS ON NEXT PAGE)

END OF SECTION



Craig Blue, P.E. Inc.
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7/8/2024
Ian Roberts
Jordan School Dist
7905 South Redwood Rd
West Jordan, UT
(801) 834-7867

ian.roberts@jordandistrict.org

RE Water Supply Analysis

This report contains the assessment of the water supply available for fire protection at the following site/address:

JSD Learning Center
3706 W 9800 S
South Jordan, UT

Report was prepared at the direction of:

Ian Roberts
ian.roberts@jordandistrict.org
Jordan School Dist
7905 South Redwood Rd
West Jordan, UT

Prepared by:
Craig Blue PE.

Background info:

The purpose of this report is to determine the amount of water supply available at the site noted above. The report shall assist authorities having jurisdiction, in determining fire suppression requirements & issuing of building permits. Comments included in report, that references 2021 International Building/Fire code are based on minimum recommended standards only. The authorities having jurisdiction may require more or less than the reference appendix.

Water & Private hydrants to site are supplied from South Jordan water system. Area is an established residential area. Private hydrants selected were highest, and farthest remote to site.

Flow Test:

The flow test was performed by Craig Blue P.E. and Connor Blue. Water flow and pressures available at hydrants nearest to site are as follows:

Static Pressure -	119	psi
Residual Pressure-	81	psi
Flowing 4.5" single outlet (32 psi-pitot):	2734	gpm
See flow data sheet for site plan, and hydrants reference elevation.		
Hydrants elev.	4623	ft. elev. Approx
Fire flow calculated for performance	4585	gpm at 20 psi

Fire Flow:

The building structure type is unknown for existing bldg. With fire sprinklers provided throughout building, the fire flow may be reduced to 25% of fire flow. The max fire flow, sprinkler reduction demand (8000 x .25 =) 2000 gpm is then required for comparison. Fire flow meets and exceeds fire flow limits noted and allows for an unlimited fire area.

Fire Sprinkler System Designs

Fire Sprinkler design should use a 15% reduction in pressures to account for demand variations in area.

15% reduced- Static 101 psi, 69 psi flowing 2734 gpm

Summary & Recommendations:

It is our opinion, that fire flow performance near site is sufficient for occupancy/use.

If there are further questions, please contact me

Craig Blue PE
C.B.P.E. Inc
801-886-3473
Craig@CBluePE.com

CBPE# 2050-26





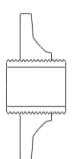
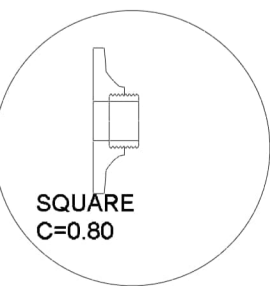
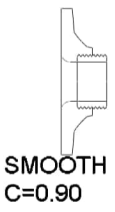
FLOW TEST DATA SHEET

Craig Blue P.E. Inc.

Fire Suppression Engineering & Testing
801-886-3473 Craig@CBluePE.com

CBPE: 2050-26

OUTLET TYPES:



WATER SYSTEM: JSD Learning Center Water System
 NAME OF PROPERTY: JSD Learning Center
 ADDRESS: 3706 West 9800 South
South Jordan, UT 84095
 DATE: 6/27/24 TIME: 11:00 am TEMPERATURE: +70 F
 TYPE OF CITY SYSTEM: _____
 TEST CONDUCTED BY: Craig Blue PE.
 WITNESSED BY: Connor Blue
 NOTES: _____

FORMULA $Q=29.83 C D^2 P^{.5}$

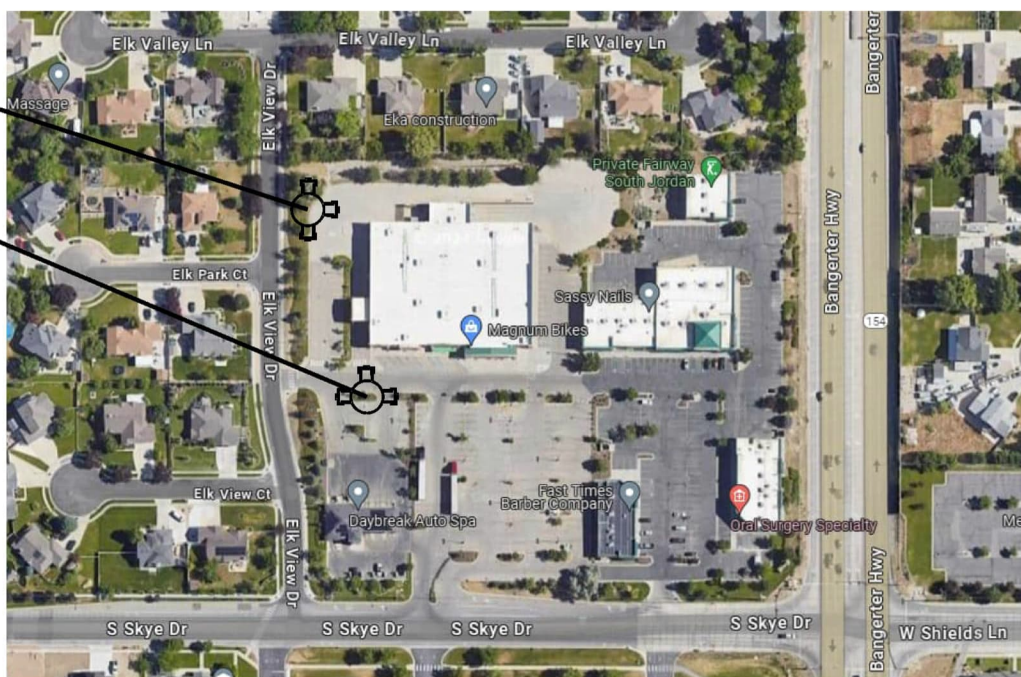
WHERE Q IS GALLONS PER MINUTE
 C IS THE COEFFICIENT OF DISCHARGE
 D IS I.D. IN INCHES OF OUTLET (2.469" typ.)
 P IS PITOT GAUGE READING (PSI)

	SIZE (IN)	PITOT (PSI)	FLOW (GPM)
OUTLET 1	4.5	32	2734
OUTLET 2			
OUTLET 3			
OUTLET 4			

FIRE FLOW: **4585 gpm @ 20psi** TOTAL FLOW: **2734 gpm**
 STATIC: 119 PSI RESIDUAL: 81 PSI ELEVATION: 4623 FT.
 SKETCH AREA MAP BELOW: hydrant elev.

HYDRANT
2734 gpm flow

119 psi Static
81 psi Residual
Elevation 4623 ft approx.





FLOW TEST DATA CHART

Craig Blue P.E. Inc.

Fire Suppression Engineering & Testing

801-886-3473

Craig@CBluePE.com

CBPE: 2050-26

WATER SYSTEM: JSD Learning Center Water System

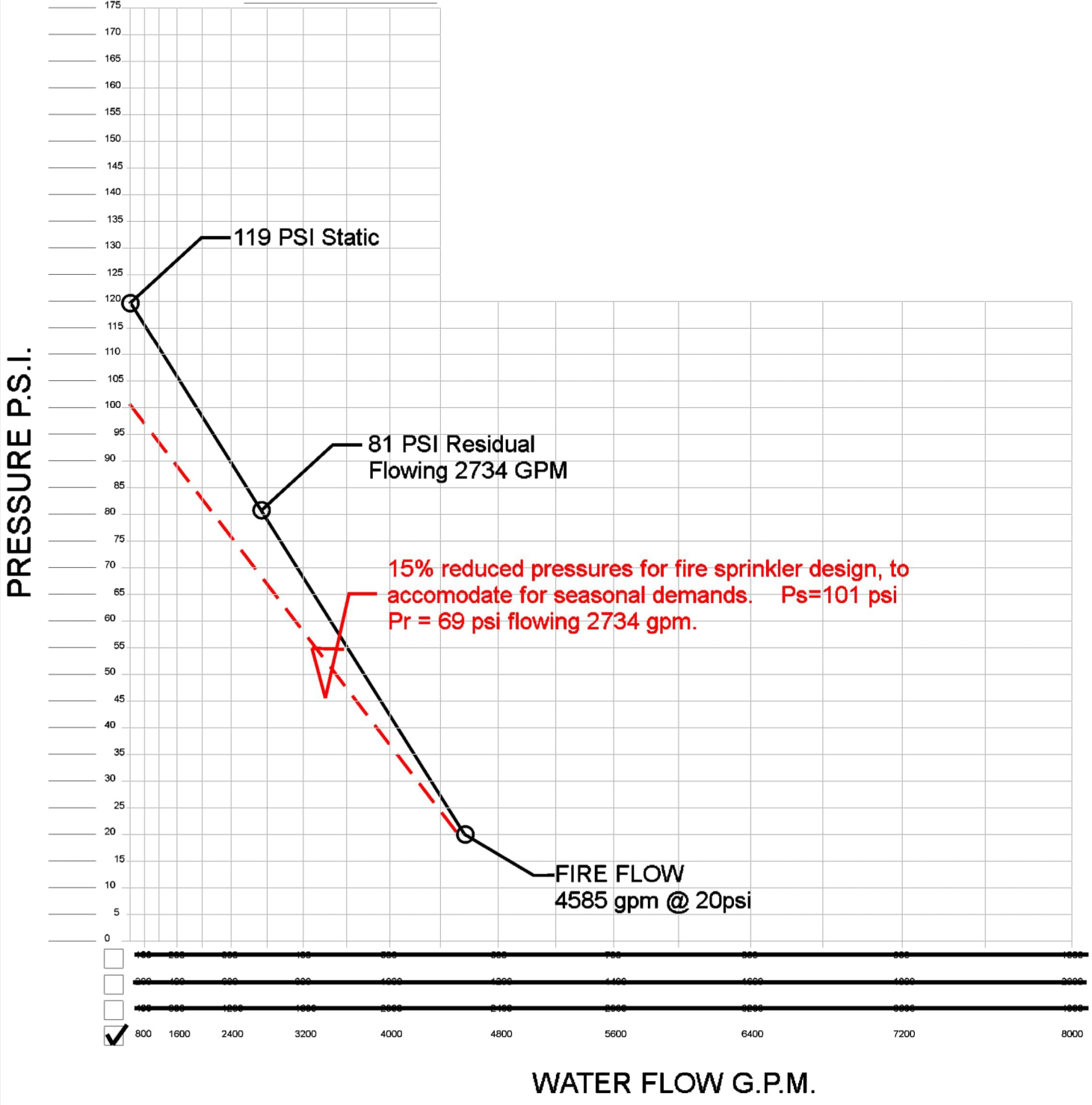
NAME OF PROPERTY: JSD Learning Center

ADDRESS: 3706 West 9800 South

South Jordan, UT 84095

SUPPLY:	119 PSI	81 PSI	2734 GPM	4585 GPM	4623 ft.
	<small>STATIC</small>	<small>RESIDUAL</small>	<small>FLOWING</small>	<small>FIRE FLOW at 20 psi</small>	<small>GRADE ELEV.</small>

DATE OF TEST: 6/27/24



504.3 Stairway access to roof. New buildings four or more stories above grade plane, except those with a roof slope greater than four units vertical in 12 units horizontal (33.3-percent slope), shall be provided with a *stairway* to the roof. *Stairway* access to the roof shall be in accordance with Section 1011.12. Such *stairway* shall be marked at street and floor levels with a sign indicating that the *stairway* continues to the roof. Where roofs are used for landscaped roofs or for other purposes, stairways shall be provided as required for such occupancy classification.

SECTION 505 PREMISES IDENTIFICATION

505.1 Address identification. New and existing buildings shall be provided with *approved* address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be not less than 4 inches (102 mm) high with a minimum stroke width of $\frac{1}{2}$ inch (12.7 mm). Where required by the *fire code official*, address identification shall be provided in additional *approved* locations to facilitate emergency response. Where access is by means of a private road and the building cannot be viewed from the *public way*, a monument, pole or other sign or means shall be used to identify the structure. Address identification shall be maintained.

505.2 Street or road signs. Streets and roads shall be identified with *approved* signs. Temporary signs shall be installed at each street intersection when construction of new roadways allows passage by vehicles. Signs shall be of an *approved* size, weather resistant and be maintained until replaced by permanent signs.

SECTION 506 KEY BOXES

506.1 Where required. Where access to or within a structure or an area is restricted because of secured openings or where immediate access is necessary for life-saving or fire-fighting purposes, the *fire code official* is authorized to require a key box to be installed in an *approved* location. The key box shall be of an *approved* type listed in accordance with UL 1037, and shall contain keys to gain necessary access as required by the *fire code official*.

506.1.1 Locks. An *approved* lock shall be installed on gates or similar barriers where required by the *fire code official*.

506.1.2 Key boxes for nonstandardized fire service elevator keys. Key boxes provided for nonstandardized fire service elevator keys shall comply with Section 506.1 and all of the following:

1. The key box shall be compatible with an existing rapid entry key box system in use in the jurisdiction and *approved* by the *fire code official*.

2. The front cover shall be permanently labeled with the words “FIRE DEPARTMENT USE ONLY—ELEVATOR KEYS.”
3. The key box shall be mounted at each elevator bank at the lobby nearest to the lowest level of fire department access.
4. The key box shall be mounted 5 feet 6 inches (1676 mm) above the finished floor to the right side of the elevator bank.
5. Contents of the key box are limited to fire service elevator keys. Additional elevator access tools, keys and information pertinent to emergency planning or elevator access shall be permitted where authorized by the *fire code official*.
6. In buildings with two or more elevator banks, a single key box shall be permitted to be used where such elevator banks are separated by not more than 30 feet (9144 mm). Additional key boxes shall be provided for each individual elevator or elevator bank separated by more than 30 feet (9144 mm).

Exception: A single key box shall be permitted to be located adjacent to a *fire command center* or the nonstandard fire service elevator key shall be permitted to be secured in a key box used for other purposes and located in accordance with Section 506.1.

506.2 Key box maintenance. The operator of the building shall immediately notify the *fire code official* and provide the new key where a lock is changed or rekeyed. The key to such lock shall be secured in the key box.

SECTION 507 FIRE PROTECTION WATER SUPPLIES

507.1 Required water supply. An *approved* water supply capable of supplying the required fire flow for fire protection shall be provided to premises on which facilities, buildings or portions of buildings are hereafter constructed or moved into or within the jurisdiction.

507.2 Type of water supply. A water supply shall consist of reservoirs, pressure tanks, elevated tanks, water mains or other fixed systems capable of providing the required fire flow.

507.2.1 Private fire service mains. Private fire service mains and appurtenances shall be installed in accordance with NFPA 24.

507.2.2 Water tanks. Water tanks for private fire protection shall be installed in accordance with NFPA 22.

507.3 Fire flow. Fire-flow requirements for buildings or portions of buildings and facilities shall be determined by an *approved* method.

507.4 Water supply test. The *fire code official* shall be notified prior to the water supply test. Water supply tests shall be witnessed by the *fire code official* or *approved* documentation of the test shall be provided to the *fire code official* prior to final approval of the water supply system.

FIRE SERVICE FEATURES

507.5 Fire hydrant systems. Fire hydrant systems shall comply with Sections 507.5.1 through 507.5.6.

507.5.1 Where required. Where a portion of the facility or building hereafter constructed or moved into or within the jurisdiction is more than 400 feet (122 m) from a hydrant on a fire apparatus access road, as measured by an *approved* route around the exterior of the facility or building, on-site fire hydrants and mains shall be provided where required by the *fire code official*.

Exceptions:

1. For Group R-3 and Group U occupancies, the distance requirement shall be 600 feet (183 m).
2. For buildings equipped throughout with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2, the distance requirement shall be 600 feet (183 m).

507.5.1.1 Hydrant for standpipe systems. Buildings equipped with a standpipe system installed in accordance with Section 905 shall have a fire hydrant within 100 feet (30 480 mm) of the fire department connections.

Exception: The distance shall be permitted to exceed 100 feet (30 480 mm) where *approved* by the *fire code official*.

507.5.2 Inspection, testing and maintenance. Fire hydrant systems shall be subject to periodic tests as required by the *fire code official*. Fire hydrant systems shall be maintained in an operative condition at all times and shall be repaired where defective. Additions, repairs, alterations and servicing shall comply with *approved* standards. Records of tests and required maintenance shall be maintained.

507.5.3 Private fire service mains and water tanks. Private fire service mains and water tanks shall be periodically inspected, tested and maintained in accordance with NFPA 25 at the following intervals:

1. Private fire hydrants of all types: Inspection annually and after each operation; flow test and maintenance annually.
2. Fire service main piping: Inspection of exposed, annually; flow test every 5 years.
3. Fire service main piping strainers: Inspection and maintenance after each use.

Records of inspections, testing and maintenance shall be maintained.

507.5.4 Obstruction. Unobstructed access to fire hydrants shall be maintained at all times. The fire department shall not be deterred or hindered from gaining immediate access to fire protection equipment or fire hydrants.

507.5.5 Clear space around hydrants. A 3-foot (914 mm) clear space shall be maintained around the circumference of fire hydrants, except as otherwise required or *approved*.

507.5.6 Physical protection. Where fire hydrants are subject to impact by a motor vehicle, guard posts or other *approved* means shall comply with Section 312.

SECTION 508 FIRE COMMAND CENTER

508.1 General. Where required by other sections of this code and in all buildings classified as high-rise buildings by the *International Building Code* and in all F-1 and S-1 occupancies with a building footprint greater than 500,000 square feet (46 452 m²), a *fire command center* for fire department operations shall be provided and shall comply with Sections 508.1.1 through 508.1.7.

508.1.1 Location and access. The location and access to the *fire command center* shall be *approved* by the *fire code official*.

508.1.2 Separation. The *fire command center* shall be separated from the remainder of the building by not less than a 1-hour *fire barrier* constructed in accordance with Section 707 of the *International Building Code* or *horizontal assembly* constructed in accordance with Section 711 of the *International Building Code*, or both.

508.1.3 Size. The *fire command center* shall be not less than 0.015 percent of the total building area of the facility served or 200 square feet (19 m²) in area, whichever is greater, with a minimum dimension of 0.7 times the square root of the room area or 10 feet (3048 mm), whichever is greater.

Where a *fire command center* is required for Group F-1 and S-1 occupancies with a building footprint greater than 500,000 square feet (46 452 m²), the *fire command center* shall have a minimum size of 96 square feet (9 m²) with a minimum dimension of 8 feet (2438 mm) where *approved* by the *fire code official*.

508.1.4 Layout approval. A layout of the *fire command center* and all features required by this section to be contained therein shall be submitted for approval prior to installation.

508.1.5 Storage. Storage unrelated to operation of the *fire command center* shall be prohibited.

508.1.6 Required features. The *fire command center* shall comply with NFPA 72 and shall contain the following features:

1. The emergency voice/alarm communication system control unit.
2. The fire department communications system.
3. Fire detection and alarm system annunciator.
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air distribution systems.
6. The fire fighter's control panel required by Section 909.16 for smoke control systems installed in the building.

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix B provides a tool for the use of jurisdictions in establishing a policy for determining fire-flow requirements in accordance with Section 507.3. The determination of required fire flow is not an exact science, but having some level of information provides a consistent way of choosing the appropriate fire flow for buildings throughout a jurisdiction. The primary tool used in this appendix is a table that presents fire flow based on construction type and building area based on the correlation of the Insurance Services Office (ISO) method and the construction types used in the International Building Code®.

SECTION B101 GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102 DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m²), used to determine the required fire flow.

SECTION B103 MODIFICATIONS

B103.1 Decreases. The *fire code official* is authorized to reduce the *fire-flow* requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full *fire-flow* requirements is impractical.

B103.2 Increases. The *fire code official* is authorized to increase the *fire-flow* requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall be not more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the *fire code official* is authorized to utilize NFPA 1142 or the *International Wild-land-Urban Interface Code*.

SECTION B104 FIRE-FLOW CALCULATION AREA

B104.1 General. The *fire-flow calculation area* shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings that are separated by *fire walls* without openings, constructed in accordance with the *International Building Code*, are allowed to be considered as separate *fire-flow calculation areas*.

B104.3 Type IA and Type IB construction. The *fire-flow calculation area* of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: *Fire-flow calculation area* for open parking garages shall be determined by the area of the largest floor.

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum *fire-flow* and flow duration requirements for one- and two-family *dwellings*, Group R-3 and R-4 buildings and *townhouses* shall be as specified in Tables B105.1(1) and B105.1(2).

B105.2 Buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum *fire-flow* and flow duration for buildings other than one- and two-family *dwellings*, Group R-3 and R-4 buildings and *townhouses* shall be as specified in Tables B105.1(2) and B105.2.

B105.3 Water supply for buildings equipped with an automatic sprinkler system. For buildings equipped with an *approved automatic sprinkler system*, the water supply shall be capable of providing the greater of:

1. The *automatic sprinkler system* demand, including hose stream allowance.
2. The required *fire flow*.

APPENDIX B—FIRE-FLOW REQUIREMENTS FOR BUILDINGS

TABLE B105.1(1)
REQUIRED FIRE FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
0–3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0–3,600	Section 903.3.1.3 of the <i>International Fire Code</i> or Section P2904 of the <i>International Residential Code</i>	500	1/2
3,601 and greater	Section 903.3.1.3 of the <i>International Fire Code</i> or Section P2904 of the <i>International Residential Code</i>	1/2 value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m.

TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

FIRE-FLOW CALCULATION AREA (square feet)					FIRE FLOW (gallons per minute) ^b	FLOW DURATION (hours)
Type IA and IB ^a	Type IIA and IIIA ^a	Type IV and V-A ^a	Type IIB and IIIB ^a	Type V-B ^a		
0–22,700	0–12,700	0–8,200	0–5,900	0–3,600	1,500	2
22,701–30,200	12,701–17,000	8,201–10,900	5,901–7,900	3,601–4,800	1,750	
30,201–38,700	17,001–21,800	10,901–12,900	7,901–9,800	4,801–6,200	2,000	
38,701–48,300	21,801–24,200	12,901–17,400	9,801–12,600	6,201–7,700	2,250	
48,301–59,000	24,201–33,200	17,401–21,300	12,601–15,400	7,701–9,400	2,500	
59,001–70,900	33,201–39,700	21,301–25,500	15,401–18,400	9,401–11,300	2,750	3
70,901–83,700	39,701–47,100	25,501–30,100	18,401–21,800	11,301–13,400	3,000	
83,701–97,700	47,101–54,900	30,101–35,200	21,801–25,900	13,401–15,600	3,250	
97,701–112,700	54,901–63,400	35,201–40,600	25,901–29,300	15,601–18,000	3,500	
112,701–128,700	63,401–72,400	40,601–46,400	29,301–33,500	18,001–20,600	3,750	
128,701–145,900	72,401–82,100	46,401–52,500	33,501–37,900	20,601–23,300	4,000	4
145,901–164,200	82,101–92,400	52,501–59,100	37,901–42,700	23,301–26,300	4,250	
164,201–183,400	92,401–103,100	59,101–66,000	42,701–47,700	26,301–29,300	4,500	
183,401–203,700	103,101–114,600	66,001–73,300	47,701–53,000	29,301–32,600	4,750	
203,701–225,200	114,601–126,700	73,301–81,100	53,001–58,600	32,601–36,000	5,000	
225,201–247,700	126,701–139,400	81,101–89,200	58,601–65,400	36,001–39,600	5,250	
247,701–271,200	139,401–152,600	89,201–97,700	65,401–70,600	39,601–43,400	5,500	
271,201–295,900	152,601–166,500	97,701–106,500	70,601–77,000	43,401–47,400	5,750	
295,901–Greater	166,501–Greater	106,501–115,800	77,001–83,700	47,401–51,500	6,000	
—	—	115,801–125,500	83,701–90,600	51,501–55,700	6,250	
—	—	125,501–135,500	90,601–97,900	55,701–60,200	6,500	
—	—	135,501–145,800	97,901–106,800	60,201–64,800	6,750	
—	—	145,801–156,700	106,801–113,200	64,801–69,600	7,000	
—	—	156,701–167,900	113,201–121,300	69,601–74,600	7,250	
—	—	167,901–179,400	121,301–129,600	74,601–79,800	7,500	
—	—	179,401–191,400	129,601–138,300	79,801–85,100	7,750	
—	—	191,401–Greater	138,301–Greater	85,101–Greater	8,000	

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

JSD Learning
8000x 25%= 2000
gpm reduced w/ fire
sprinklers. 7/1/24

**TABLE B105.2
REQUIRED FIRE FLOW FOR BUILDINGS OTHER THAN ONE- AND
TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES**

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the <i>International Fire Code</i>	25% of the value in Table B105.1(2) ^a	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the <i>International Fire Code</i>	25% of the value in Table B105.1(2) ^b	Duration in Table B105.1(2) at the reduced flow rate

For SI: 1 gallon per minute = 3.785 L/m.

a. The reduced fire flow shall be not less than 1,000 gallons per minute.

b. The reduced fire flow shall be not less than 1,500 gallons per minute.

**SECTION B106
REFERENCED STANDARDS**

B106.1 General. See Table B106.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE B106.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
IBC—21	<i>International Building Code</i>	B104.2
IRC—21	<i>International Residential Code</i>	Table B105.1(1)
IWUIC—21	<i>International Wildland-Urban Interface Code</i>	B103.3
NFPA 1142—17	<i>Standard on Water Supplies for Suburban and Rural Fire Fighting</i>	B103.3

SECTION 22 0000 - PLUMBING

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Piping diagrams are schematic and indicate preferred pipe routing. It is the intent that the installation be complete. Where fixtures are not shown connected to any required services, they shall be connected properly and completely. Connect all fixtures to various services, i.e., hot water, cold water, waste, and vent, etc., as required.
- B. The work shall include furnishing of all materials and labor required for the job as described, together with all accessories and trim implied or required to finish the work, and generally as follows:
 - 1. Demolition of existing systems
 - 2. Modifications to the existing rain removal system, including piping and roof drains.
 - 3. Plumbing fixtures and piping.
 - 4. Re-Build of existing main water PRV.
 - 5. Water Heater.
 - 6. Water softener.
 - 7. Sanitary sewer systems.
 - 8. Natural gas systems
 - 9. Backflow prevention systems.
 - 10. Condensate drain systems.
 - 11. Final connection of building systems.

1.2 STANDARDS

- A. Plumbing installation shall be made in accordance with the 2021 International Plumbing Code, City Code, and all other governing codes.
- B. In the event drawings violate the codes as being locally enforced, the contractor shall base his estimate on the enforced code requirements.

1.3 DISINFECTING

- A. After flushing the mains, introduce a water and chlorine solution concentrated to 300 PPM to disinfect the system and oxidize piping contaminates. Retain treated water and chlorine for a period of not less than three hours or more than six hours before final flushing out of system.
- B. All valves should be opened periodically during the process and the residual chlorine checked to ensure that at least 50 percent of the initial concentration is present to complete the disinfection. If there is less than 50 percent, the valves should be allowed to drain water until the 50 percent or greater level is obtained. A make-up chlorine solution of a concentration equal to the initial concentration must be added as needed during the withdrawal of the spent solution.
- C. A warning sign shall be conspicuously posted at each water outlet and faucet during the disinfecting process to prevent occupants from drinking the water.

- D. Flushing: Following disinfection, all treated water shall be flushed from the system through its extremities. Flushing shall continue until samples show that the quality of the water delivered is comparable with the quality of the public water supply and satisfactory to the public health authority having jurisdiction. Flushing shall be repeated if samples taken daily over a period of three days show the water quality is not being maintained. Samples shall be taken only from taps located and installed in such a manner that they will not contribute any contamination. Samples shall not be drawn from hydrants or through unsterilized hose. Test samples shall be certified by a recognized and approved testing laboratory, and a certificate of acceptability shall be submitted.
- E. Written certification of the disinfecting process and purity of water samples shall be forwarded to the Owner's representative.

1.4 VERIFICATION OF GRADE

- A. The contractor shall verify with the site utilities contractor the connection of water, and waste piping systems to the mains, and shall verify the actual job site elevation and location prior to the installation of the building footings.

PART 2 – PRODUCTS

2.1 CLEANOUTS

- A. Approved cleanouts shall be installed in the base of each vertical drainage line, and in the horizontal line at each change in direction. In addition, there shall be cleanouts spaced at a maximum of 50' in all horizontal lines. All cleanouts shall be extended to accessible surfaces. All cleanouts to grade shall be capable of cleaning in both directions.

2.2 WATER HAMMER

- A. Provide and install stainless steel bellows type shock absorbers in the ends of all multiple fixture water lines and in piping ahead of snap-acting automatic valves.
- B. Absorbers shall be sized and located in compliance with manufacturer's recommendations for the specific application. Absorbers shall be Zurn, Wade, or Smith.
- C. Absorbers shall not be installed in inaccessible areas. Extend piping to accessible locations.

2.3 FLASHINGS

- A. All pipes passing thru the roof shall be neatly flashed. Flashing shall be provided under Division 7.

2.4 FIXTURE STOPS

- A. All stops for plumbing fixtures shall be McDonald 1/4 turn ball valves.

2.5 PLUMBING FIXTURES

- A. This contractor shall furnish and install all fixtures shown on the architectural or mechanical drawings or specified hereinafter, clean and adjust all fixtures and replace any damaged fixtures at the contractor's expense.

B. The fixtures shall be all new and complete as shown and described in manufacturer's catalog, and as required for the work, including accessible loose key 1/4 turn ball valve stops above the floor in supplies to all fixtures, and cast brass P-traps, unless otherwise shown. Trim for all fixtures shall be chrome-plated, and all trim shall match in design. Supply faucets shall have renewable seats and barrels. Fixtures shall be Kohler, American Standard, Crane, or approved equal.

C. Approved Fixtures:

Water closets, urinal & lavatories:	Kohler, American Standard, Zurn, or approved equal
Flush valves:	Zurn, Sloan, or approved equal.
Sinks:	Just, Elkay, or approved equal.
Faucets:	Moen, Kohler, American Standard, or approved equal.
Drinking fountains:	Murdock, Acorn, Elkay, or approved equal.
Shower trim:	Symmons, Bradley, T&S Brass, Moen, or approved equal.
Hose bibbs:	Watts, Zurn, JR Smith, Woodford, or approved equal.
Emergency fixtures:	Bradley, Symmons, Haws, or approved equal.
Tempering valves:	Bradley, Symmons, Watts, or approved equal.
Floor drains, floor sinks:	Zurn, JR Smith, Watts, Josam, or approved equal.
Trench drains:	Polydrain, Josam, Zurn, or approved equal.
Roof drains, downspouts:	Zurn, Watts, J.R. Smith, or approved equal.

PLUMBING FIXTURES

WC-1	Water Closet:	American Standard "Afwall" Millenium, syphon jet, 1.6 gpf, wall hung, elongated bowl, 1-1/2" top spud; Sloan 'Crown' 111-1.6 gpf chrome plated, piston type exposed flush valve; K-666C Bemis 1955C extra heavy solid plastic white open front seat with stainless steel check hinge; Wade W-311 (horizontal) or W-331 (vertical) series carrier, single or double right or left as required, with foot support.
WC-2	Water Closet: (ADA)	Same as "WC-1" - Set at handicapped height.
WC-3	Water Closet: (ADA)	American Standard "Madera" siphon jet, 1.6 gpf, floor mounted, elongated lip bowl, 1-1/2" top spud, vitreous china, Sloan 'Crown' 111-1.6 gpf chrome plated, piston type exposed flush valves; K-4666-C Bemis 1955C extra heavy solid plastic white open front seat with stainless steel check hinge, 431310-100 bolt caps.
U-1	Urinal:	American Standard "Washbrook" FloWise 6501.511 vitreous china, wall hung, siphon jet with flushing rim, 2" outlet connection, 3/4" top spud with Sloan Optima Plus 8186 1.0 gpf, exposed battery powered sensor operated chrome plated flush valve with vacuum breaker and battery, plate type carrier and bearing plate. Wade W-452 Zurn 1222, Smith 633.

U-2	Urinal: (ADA)	Same as U-1. Mount at handicapped height.
L-1	Lavatory: (ADA)	American Standard "Lucerne" 035.028" 20" x 18" 4" center set vitreous china, front overflow, anti-splash rim, center basin, wall hanger, punched for concealed arm carrier, Chicago 802-1000-PRJKCP, 2.2 gpm, 4" center set vandal resistant manual faucet with integral cast brass spout. Provide grid strainer. Tailpiece and flexible supplies w/stops and brass P-trap. Support lavatory with Zurn ZN1231 concealed arm carrier with foot support. Lavatory shall have both tempered water and cold-water connections.
S-1	Sink:	Elkay LR2219 17" x 20" x 7-5/8", 18 ga. single compartment stainless steel, drilled for 3-hole 8" centerset faucet, self-rimming, sound dampening, cup strainer, Chicago 786-E29-369ABCP faucet with swing spout, ADA levers, and aerator, flexible supplies, brass P-trap.
S-2	Sink:	Elkay LR2219 17" x 20" x 7-5/8", 18 ga. single compartment stainless steel, drilled for 3-hole 8" centerset faucet, self-rimming, sound dampening, cup strainer, Chicago 786-E29-369ABCP faucet with swing spout, ADA levers, and aerator, flexible supplies, brass P-trap.
S-3	Sink:	Elkay PSR-3319 33" x 19-1/2" x 7" deep with (2) each 14" x 14" bowls, 20 ga. stainless steel self-rimming sink, soft satin finish with 2-hole flush fittings deck and sound dampening. Single lever Chicago 1100-L9-317ABCP 8" swing spout kitchen deck faucet, and vandalproof aerator, flexible supplies, crumb cup strainer with the tailpiece and cast brass P-trap.
S-3	Sink:	Elkay LR2219 17" x 20" x 7-5/8", 18 ga. single compartment stainless steel, drilled for 3-hole 8" centerset faucet, self-rimming, sound dampening, cup strainer, Chicago 786-E29-369ABCP faucet with swing spout, ADA levers, and aerator, flexible supplies, brass P-trap.
S-4	Sink:	Elkay LR2219 17" x 20" x 7-5/8", 18 ga. single compartment stainless steel, drilled for 3-hole 8" centerset faucet, self-rimming, sound dampening, cup strainer, Chicago 786-E29-369ABCP faucet with swing spout, ADA levers, and aerator, flexible supplies, Zurn Model Z1180 solids interceptor.
S-5	Sink:	Elkay LR2219 17" x 20" x 7-5/8", 18 ga. single compartment stainless steel, drilled for 3-hole 8" centerset faucet, self-rimming, sound dampening, cup strainer, Chicago 786-E29-369ABCP faucet with swing spout, ADA levers, and aerator, flexible supplies, Acid waste tailpiece, Zurn Model Z9A-PHIX acid neutralization cartridge.
S-6	Sink:	Elkay LR2219 17" x 20" x 7-5/8", 18 ga. single compartment stainless steel, drilled for 3-hole 8" centerset faucet, self-rimming, sound dampening, cup strainer, Chicago 786-E29-369ABCP faucet with swing spout, ADA levers, and aerator, flexible supplies, brass P-trap.

SS-1	Service Sink: (Floor type)	Kohler K-6710 "Whitby" 28" x 28" service sink, floor mounted, drain channels; Chicago 445-897SRXKCCP chrome plated wall mounted service sink faucet with vacuum breaker, 3/4" threaded hose end with hose, bucket hook, wall brace integral stops and rough chrome finish. Faucet to be mounted 30" above finish floor; K-8940 rim guard; K-9146 drain with strainer for 3" connection.
DF-1	Drinking Fountain:	Elkay LZS8WSSP Single-level, wheelchair access, wall mounted, air cooled, refrigerated type with bottle filler to cool 8 gal/hr. from 80 deg. F. EAT.120/160. 304 stainless steel top w/chrome plated bubbler and "Light Touch" wrap and self-closing press bar operable from front of fountain. Cabinet color shall be stainless steel #4 satin finish. Note: Cut electrical cord at time of installation to suit electrical outlet provided.
WB-1	Washer Box:	Guy Gray WB-200 "Duo-Cloz" for on-the-wall installation with concealed piping, dual 1/2" ball valves with single level on-off control and hose connections. Rough chrome plate finish. (Verify mounting height with existing conditions). Provide 1-1/2" standpipe drain with P-trap for waste connection.
IMB-1	Ice Maker Box:	Guy Gray BIM-875 for in-the-wall installation with concealed piping, 1/2" ball valve. 18-gauge dipped galv. steel finish. Face plate with 20-gauge box. (Verify mounting height with conditions).
HB-1	Hose Bibb:	Zurn Z-1320CL 3/4" "Ecolotrol" non-freeze anti-siphon wall hydrant with copper casing, nickel bronze face, integral vacuum breaker, locking cylinder & wall clamp. Minimum length from face to valve 12". Hydrant to be centered in block course.
HB-2	Hose Bibb:	Zurn Z-1350 Encased Ecolotrol "anti-siphon" wall hydrant, for interior wall installation. Complete with integral backflow preventer, all bronze interior parts, non-turning operating coupling with hemispherical neoprene plunger and 3/4" solder cold and hot inlet. Stainless steel box and hinged cover with operating key lock and "WATER" stamped on cover.
HB-3	Hose Bibb:	Chicago Faucet No. 952 (No. 998 where connected to exposed piping) 3/4" chrome plated hose bibb with No. 293-6 handle and 3/4" threaded outlet with integral vacuum breaker.
HB-4	Hose Bibb:	Chicago Faucet No. 952 (No. 998 where connected to exposed piping) 3/4" chrome plated hose bibb with No. 293-6 handle and 3/4" threaded outlet with integral vacuum breaker. Mount at 60" AFF.
TV-1	Tempering Valve:	Watts Model USG-B ASSE 1070 single lavatory mixing valve with integral strainer.

TV-2	Tempering Valve: (Emergency Eyewash)	Leonard Model TA-300-RF emergency mixing valve, 1/2" inlets and 1/2" outlet, to mix cold water with 120 deg. F. hot water for 85 deg. F. tempered water supply. 0.5 GPM min. flow and 6 GPM at 20 psi pressure drop. Manifold shall be complete with temperature gauge, inlet check stops, and cold water bypass.
FD-1	Floor Drain:	Zurn #Z-415-4 2" cast iron drain with nickel bronze top. Drain to have deep seal P-trap with Provent "trap guard".
FS-1	Floor Sink:	Zurn ZN-1900-2" sanitor floor sink with 12" x 12" square top, full removable grate with center opening. N.B. dome, sani-coated exterior, acid resistant enamel interior, and Z-100 deep seal trap. Sink shall be complete with full grate, 3/4 grate, 1/2 grate, etc. as necessary to match application. Sink to be installed flush with floor.
EW-1	Emergency Eyewash: (Recessed)	Guardian GBF1735DP, Barrier Free, recessed, wall mounted, eye/face wash with swing-down stainless steel drain pan. Unit construction shall be welded 16-gauge type 304 stainless steel with #4 brushed satin finish. Unit shall include chrome-plated brass eye/face wash supply fittings, 1/2" IPS brass rotating plug-type valve with PTFE coated O-ring seals, in-line strainer to protect valve and spray heads from debris in water line, and 2" IPS drain. Unit shall have (2) polypropylene FS-Plus™ spray heads with integral filters. Activate valve by rotating 90° from stored position. Unit shall include ANSI compliant sign.
NT-1	Neutralization cartridge	Zurn Model Z9A-PHIX acid neutralization cartridge.
RD-1	Roof Drain:	J.R. Smith #1010-ARC, roof drain cast iron type with flashing collar, C.I. dome, gravel guard, extension, sump receiver, and underdeck clamp. See plans for sizes.
RD-2	Roof Drain: (Secondary)	J. R. Smith #1080-ARC w/2" water dam, duco cast iron body with combined flashing clamp and gravel stop with underdeck clamp, extension, sump receiver, and cast-iron dome. See plans for sizes.
DN-1	Downspout Nozzle:	Smith #1770 brass downspout nozzle. Provide 1/4" mesh aluminized, slip fit bird screen. See plans for sizes.

2.6 WATER HEATER (WH-1)

- A. Water heater shall be natural gas fired, 75-gallon high efficiency w/ AGA approved gas train. 100,000 BTUH input with 129 GPH recovery thru 90 deg. F. temp. 3" PVC vent and air intake with factory roof termination kit. 75-gallon glass lined ASME:"H" stamp vertical storage tank with pressure and temperature relief valve, insulated jacket with baked enamel finish, complete with all controls for automatic operation. The heater shall be designed for 120 deg. F. operation. 120/1/60 power.

Make & Model: Bradford White, A. O. Smith or Rheem equivalent
Nominal Size: 26-1/4" Dia. x 62-1/4" H.
Shipping Weight: 300 lbs.

2.7 LEAD PANS AND WATERPROOF MEMBRANES

- A. Furnish a 30" square 4# lead flashing with each roof drain.
- B. All floor drains shall be fitted with clamping collar and waterproof membrane.
- C. Membrane and lead waterproofing pans for shower stalls and built-up type custodial floor sinks shall be furnished and installed by plumbers so they are 100% watertight. Drains shall have clamping device which clamps drain to pans. There shall be a mastic seal between floor drain bottom and lead or membrane so when clamping device is tightened, there is a complete watertight seal.
- D. Care should be taken not to clog weep holes. All pans will be tested by placing test plug in drain and filling with water overnight.

2.8 CONDENSATE DRAIN

- A. All refrigerated air conditioning and/or cold storage cases which have cooling coil condensate drip pans with pipe connections shall be piped to the nearest drain by this contractor.
- B. Pipe location and routing shall be approved by the owner's representative.
- C. Piping shall be the same size as the drain pan connection and shall be trapped to prevent forced air flow thru the pipe.

2.9 VACUUM BREAKERS, DOUBLE CHECK VALVE ASSEMBLIES, & BACKFLOW PREVENTERS

- A. Vacuum breakers and backflow preventers shall comply with the requirements of the 2021 IPC and Utah State Plumbing Code for the actual installed duty.
- B. Vacuum breakers and backflow preventers shall be of the type, style, and arrangement approved by the Code.
- C. All vacuum breakers and backflow preventers shall be installed with the necessary isolation valves and test cocks.
- D. Backflow preventers shall be located at a maximum of 4' - 0" A.F.F. and shall be accessible for service. Backflow preventers shall have a water filter with a replaceable cartridge.

2.10 SEISMIC GAS SHUT-OFF VALVE

- A. Valve shall be seismically activated type with positive shut-off seal and automatic non-creeping mechanism with manual reset and visual open-close indicator.
- B. Valve shall be U.L. listed for natural gas use and meet Standards for Earthquake Activated Automatic Gas Shut-off Systems, Standard No. 12-23-1, and ANSI Z21.70 1981.
- C. Shut-off shall activate within five seconds when subjected to a horizontal sinusoidal oscillation having a peak acceleration of 0.3 G and a period of 0.4 seconds.
- D. Positive seal shall be provided from -10 deg. F. to +150 deg. F. at 20 psi gas pressure.

- E. Seismic shut-off valve shall be Koso Model 2" 3/4 HP or approved equal.

2.11 GAS PRESSURE REGULATORS

- A. Furnish and install, as required, approved type gas pressure regulators in gas piping ahead of appliance and equipment. Regulators located outside of building shall have weatherproof vent with bugproof screen. Regulators located inside of building shall be vented to the outside with approved cap screen. Approved manufacturers of gas regulators are Fisher and Reliance.

2.12 CIRCULATORS

- A. Furnish and install the circulators shown and specified on the drawings. Circulators shall be of the in-line, pipe-mounted, motor driven, centrifugal type. All motors shall operate at 1750 RPM. Circulators shall operate at high efficiency and shall have a quiet, vibrationless operation. Provide steel support for motor. All circulators to be all bronze construction.
- B. Circulators shall be Bell & Gossett Taco or Gundfoss.

PART 3 – EXECUTION

3.1 PRODUCT HANDLING

- A. Protection:

Use all means necessary to protect plumbing materials before, during, and after installation and to protect the installed work and materials of all other trades.

- B. Replacements:

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

3.2 TESTING

- A. Furnish all required personnel and equipment and make all tests required to receive the approval of the Owner and all agencies having jurisdiction.

3.3 SAWCUTTING OF EXISTING FLOOR SLABS

- A. All saw cutting, backfill & compaction where noted for removal of existing systems or installation of new systems shall be coordinated with all trades and project architect.

3.4 CLEANING UP

- A. Prior to acceptance of the building, thoroughly clean all exposed portions of the plumbing installation, removing all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item and being careful to avoid all damage to finished surfaces.

3.5 ROOF DRAIN LOCATIONS

- A. Roof drains are existing and shall remain.
- B. The existing roof drain piping is PVC material and shall be removed and replaced with cast iron piping.

3.6 WATER CLOSET INSTALLATION

- A. General: Install water closets as shown on the drawing and as follows:
 - 1. Supply pipe extending from wall shall be covered by chrome plated sleeve and wall flange.
 - 2. Additional wall plates shall be provided where each pipe extends through finished wall.
 - 3. Two rubber or plastic seat bumpers with metal holders shall be provided and secured to the wainscot behind the fixture.
 - 4. The centerline of the flush valve shall be on the centerline of the fixture, 39 inches above the finished floor and a minimum of 2-1/4 inches from the wall.
 - 5. Chrome plated pipe support shall be provided on the long flush pipe outlet and shall be secured rigidly to the wall with suitable anchors.
 - 6. The backflow preventer for the flush valve shall be installed at the discharge of the valves.
 - 7. The flush valve water piping concealed in the partition shall be rigidly supported; piping between flush valve and wall shall be provided with a factory fabricated chromium plated spacer sleeve and wall flange.
 - 8. Closet carrier shall be installed inside stud wall system. Installation outside of stud wall system will not be accepted.

3.7 LAVATORY INSTALLATION

- A. General: Install lavatories as shown on the drawings and as follows:
 - 1. Lavatories for use by wheelchair handicapped shall be installed with a minimum rim height of 34", a minimum vertical clearance of 29" from floor, and a minimum clear knee recess of 30" in width and 20" in depth.
 - 2. Trap on lavatory for use by wheelchair handicapped shall be installed so as to provide maximum clearance under bowl. Exposed waste, trap and hot water supply under lavatory shall be insulated in accordance with the requirements for domestic hot water piping.
 - 3. All lavatories shall be installed with a rim height of 34".

3.8 URINAL INSTALLATION

- A. General: Install urinals as shown on the drawing and as follows:
 - 1. Supply pipe extending from wall shall be covered by chrome plated sleeve and wall flange.
 - 2. Additional wall plates shall be provided where each pipe extends through finished wall.
 - 3. The centerline of the flush valve for wall hung urinals shall be on the centerline of the fixture, 45 inches above the finished floor and a minimum of 2-1/4 inches from the wall.
 - 4. The centerline of the flush valve for handicap urinals shall be 40 inches or less above the finished floor.
 - 5. The backflow preventer for flush valve shall be installed at the discharge of the valve.

6. The flush valve and the water piping concealed in the partition shall be rigidly supported; piping between flush valve and wall shall be provided with a factory fabricated chromium-plated spacer sleeve and wall flange.
7. Horizontal urinal piping shall be schedule 40 solid core PVC epoxy coated piping.
8. Provide Schedule 40 solid core epoxy coated PVC spool piece at urinal.
9. Urinal carrier shall be installed inside stud wall system. Installation outside of stud wall system will not be accepted.

3.9 FIXTURE CONNECTIONS

- A. Floor Mounted Water Closets and Service Sinks: Provide connections between soil pipes and floor connected water closets and service sinks made with cast-iron floor flanges.
- B. Connection sizes shall be 4-inch for water closets and 3-inch for service sinks.
- C. Floor flanges shall be slipped over the ends of the pipes and caulked in position.
- D. Special short radius fittings shall be used where space does not permit the use of standard fittings below the flanges.
- E. Setting Compounds and Gaskets: Provide watertight and gas tight seals between flanges and fixtures with plumbing-fixture-setting compound or manufacturer's standard non-asbestos gaskets.
- F. Neither rubber gaskets nor putty shall be used in sealing connections.

3.10 FIXTURE SUPPORTS

- A. Urinal Support: Provide urinal chair carriers consisting of a pair of cast-iron feet bolted to or imbedded into the floor together with 1.66-inch outside diameter (minimum), steel tubular upright members, steel hanger support plate, and steel bearing plate connected to cast iron or steel adjustment sleeves and furnished with necessary bolts, nuts, washers, and chrome plated trim. Provide chair carrier that is fully concealed in the building construction and that supports the fixture in such a manner that no part of the fixture will be supported by the wall or the partition.
- B. Lavatory Support: Provide lavatory chair carriers consisting of a pair of cast-iron feet bolted to or imbedded into the floor together with 1.66- inch (minimum) steel tubular upright members, a horizontally adjustable alignment truss or tie rod at bottom and another at the top connected to cast-iron or steel adjustment sleeves and painted cast-iron or steel adjustment sleeves, and painted cast-iron concealed arms.

3.11 INSTALLATION OF PRESSURE REDUCING VALVES

- A. General: Install one or more pressure reducing valves on the main water line supplying plumbing fixtures.
 1. Provide each pressure reducing valve with a gate valve and union on both the inlet and outlet connections.
 2. A bypass one pipe size smaller than the main water line provided with a globe valve and union, shall be installed between the inlet and outlet sides of the pressure reducing valve assembly.
 3. Pressure gauges shall be installed at the inlet and outlet connections to the pressure reducing valve assembly. Gauges shall have T-handle stops in their connections.

3.12 STRAINER INSTALLATION

- A. General: Place strainers ahead of pressure reducing valves, automatic control valves, pumps, and elsewhere as indicated on the drawings or specified.

3.13 BACKFLOW PROTECTION VALVE INSTALLATION

- A. General: The entire water distribution system shall be protected against contamination due to backflow from non-potable sources. Each connection to a fixture or an item of equipment shall be protected in accordance with the requirements of the National Plumbing Code.
- B. Reduced Pressure Zone Backflow Preventer: Install a reduced pressure zone backflow preventer in the building water supply main to expansion tanks as shown on the drawings and/or as required by the local codes.

3.14 INSTALLATION OF PIPE SLEEVES

- A. Basic Requirements: Install pipe sleeves as follows:
 - 1. Pipe sleeves shall be provided for all pipes passing through walls, slabs on grade and floors. Sleeves may be omitted where pipes pass through exterior walls above ground to lawn faucets, wall hydrants and downspout nozzles.
 - 2. Sleeves for pipes passing through exterior walls and slabs on grade which do not have membrane waterproofing shall be of cast-iron or galvanized steel pipe or black steel pipe, Schedule 40.
 - 3. Sleeves for pipes passing through exterior walls, slabs on grade and floors which are provided with membrane waterproofing shall be of threaded galvanized steel pipe fitted with companion flanges and arranged to secure membrane. Companion flanges shall be drilled and tapped in such a manner that bolting is affected from the outer (or upper) face only.
 - 4. Sleeves for pipes passing through potentially wet floors that do not have membrane waterproofing such as in toilet rooms, utility cores, mechanical equipment rooms, and areas that are provided with fire protection sprinkler systems, shall be galvanized steel pipe, shall project 2 inches above the finished floors, and shall be caulked watertight.
 - 5. Sleeves for pipes passing through all other floors and walls shall be constructed of galvanized or black steel pipe, standard weight.
- B. Sleeves On New Work: On new work, sleeves shall be built into the walls and floors as the work progresses.

3.15 INSTALLATION OF CLEANOUTS AND FERRULES

- A. Riser Connection to Sewer or Drain: Where soil, waste, or roof drainage risers connect to a sewer or drain extending from the building above the lowest floor, the fitting at the base of each stack or downspout shall be a sanitary tee or a combination Y and 1/8 bend with cleanout plug in the end of the run of the main.
- B. Test Tees: Each vertical soil, waste, and vent pipe and each downspout and roof drainage pipe which connects to horizontal drain piping below ground shall be fitted with a test tee above the lowest floor or ground. Where accessible, test tee may be installed in the horizontal pipe at the base of the riser.
- C. Cover Plates: Where cleanouts or test tees occur on concealed pipes in finished rooms, they shall be provided with a 1/8-inch thick, machine finished, brass cover plate of sufficient diameter to cover

the opening in the finished wall or partition. The cleanout plug shall have a solid head, tapped for a 1/4-inch brass screw to secure the cover plate. Where cleanout plugs extend beyond the wall finish, the cover plates shall be of machine finished brass and shall be only of sufficient depth to fit against the wall to cover plug. Cleanout cover plates shall be painted to match adjacent wall finish.

- D. Cleanouts Plugs for Threaded Fittings: Cleanout plugs for threaded fittings shall be in accordance with ANSI B16.12. Except for test openings, where size must be sufficient to admit test plug, bushings will be permitted on pipes 5-inches and larger to reduce plug size to 4 inches; cleanout plugs for piping 4 inches and smaller shall be the same size as the pipe.
- E. Cleanout Plugs for Hub-and-Spigot Fittings: Cleanout plugs for hub-and-spigot fittings shall be screwed into ferrules caulked into the fitting. Ferrules and plugs shall be in accordance with ANSI B16.12, except that plugs required to be flush with the floor shall have square countersunk heads in lieu of raised heads.
- F. Cleanout Plugs for Copper Drainage Lines: Cleanout plugs on copper drainage lines shall be installed in solder-joint fittings having threaded openings provided for the cleanout, or in solder-joint fittings with threaded adapters.

3.16 WATER PIPING INSTALLATION

- A. General: Water piping shall be complete from service connection to all fixtures and equipment outlets. Sizes of pipes shall be as shown or specified.
- B. Reaming: Ends of pipes and tubes shall be reamed before being made up.
- C. Threaded Joints: Threaded joints shall be made up metal-to-metal, with a noncorrosive lubricant applied to the male thread only. Lampwick or other packing material shall not be used in making up threaded joints.
- D. Chromium Plated Piping: Chromium plated piping shall be threaded and made up carefully, and not more than one full turn of thread shall be exposed beyond any fittings.
- E. Long Screws and Bushings: Long screws and bushings (other than bushings cast in the sand) shall not be used on water piping.
- F. Soldering: Ends of tubing and recesses of fittings to be soldered shall be thoroughly cleaned. Joints shall be assembled without binding. Solder shall penetrate fully and shall fill the joint completely. Joints shall be made using lead-free solder, as specified.
- G. Joint Materials: All joint materials shall be free from oil, tar, and greasy substances, and shall be dry when placed in the joint. The material shall be handled with care to prevent contamination.
- H. Copper Tubing: All copper tubing shall be free from cuts, dents or other surface damage at the time of final inspection. Damaged tubing shall be removed and replaced with new.
- I. Copper Tube Anchoring: Horizontal runs of copper tubing over 50 feet in length shall be anchored to wall or floor construction. Anchors shall be located near the midpoints of the runs so as to force the expansion equally to the ends or in a direction where expansion can take place without excessive strain.

- J. Swing Joints, Offsets, and Expansion Joints: Swing joints, offsets, and expansion joints shall be provided where necessary to accommodate expansion of piping, which will be approximately two inches in 100 feet of copper hot water piping.
- K. Dielectric Couplings: Where non-ferrous metal piping and zinc-coated metal piping are joined, brass couplings, fittings or unions shall be provided.
- L. Reducing Fittings: Where pipe sizes shown or specified differ from the connection sizes of meters, pumps, fixtures, outlets, and the like, reducing fittings shall be installed close to them.
- M. Pipe Branches: Branches from water supply mains shall be taken from the top, bottom or side, using crossover fittings where required by structural or operating conditions.
- N. Upfeed Hot Water Return: On upfeed hot water distribution systems for which return circulation piping is shown, a 1/2" circulation connection shall be made at a point on each riser just below the highest outlet connection. Provide branch circulation lines with gate valves near the valves on corresponding supply lines.
- O. Downfeed Hot Water Supply: Each downfeed main for a hot water supply system shall be graded upward to the first branch connection, which shall be taken from the top of the main. Beyond the first connection the main shall grade downward, and all branch connections shall be taken from the bottom of the main. Connect a 1/2-inch circulating line to the bottom of each downfeed riser. Provide branch circuiting lines with gate valves in locations corresponding to the supply branch valve locations.
- P. Grading: Hot water supply and hot water circulating lines shall be accurately and uniformly graded to avoid traps which might impede or destroy circulation. All lines shall be graded so as to facilitate drainage.
- Q. Unions: Unions shall be installed near points of connection to each piece of equipment, and elsewhere as required for installation of piping, removal and replacement of regulating and control equipment and the like. Right and left couplings or nipples are prohibited.
- R. Water Hammer Arresters: Water hammer arresters shall be provided where indicated on the drawings. Water hammer arresters shall be approved and installed in accordance with the requirements of PDI-WH201 and shall bear the PDI seal of approval.
- S. Roughing: Roughing shall be provided for equipment furnished under other sections of the specifications.
- T. Where future extensions are indicated on the drawings, roughing shall extend to within the space to be served and shall be valved and capped or plugged.

END OF SECTION

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SECTION 22 0700 - INSULATION

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. It is the intent of this section of the specifications that all hot (above 105 deg. F.) and cold (below 55 deg. F) surfaces of all piping and mechanical system components be insulated, unless specifically excluded herein.
- B. Systems to be insulated:
 - 1. Supply air ductwork
 - 2. Culinary hot and cold-water piping systems
 - 3. Roof drain piping systems. Existing & new as noted on drawings.
 - 4. Water, tempering valve and pipe, and waste lines below lavatories and ADA sinks
 - 5. Refrigerant suction lines
- C. The providing of all materials, supplies, equipment, tools, transportation, and facilities and performing all labor and service necessary to provide the work outlined above and as shown on the working drawings.

PART 2 – PRODUCTS

2.1 COMPLIANCE

- A. All insulation shall (as a minimum) conform to the requirements of the building code and shall have a flame spread rating of less than 25 and smoke developed less than 50.
- B. Insulation shall be as manufactured by Johns-Manville, Owens-Corning, Knauf, Armstrong, or Certainteed.

2.2 DOMESTIC HOT & COLD-WATER PIPING

- A. All piping shall be insulated with 2-piece heavy density pipe insulation having an average thermal resistivity in the range of 4.0 to 4.6 Hr Deg. F. Ft²/BTU per inch of thickness on a flat surface at a mean temperature of 75 deg. F. Thickness of insulation shall be as follows:

MINIMUM PIPE INSULATION THICKNESS IN INCHES FOR PIPE SIZES**

PIPING SYSTEM TYPES	FLUID TEMP. RANGE, F	RUN-OUTS 2"*	1" & LESS	1-1/4" TO 2"	2-1/2" TO 4"	5" TO 6"	8" +
DOMESTIC HOT & HOT RECIRCULATING							
HS/HWR	120/200	1	1	1	1	2	2
DOMESTIC COLD-WATER SYSTEMS							
Cold, Make-up Water, etc.	40-55	1/2	1/2	3/4	1	1-1/2 To 2	2-1/2 & above
REFRIGERANT SYSTEMS							
Refrigerant Suction	Below 40	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2

** For piping exposed to outdoor air, increase thickness by 1/2".

- B. Pipe insulation shall be covered with an all-service jacket.
- C. Duct insulation, pipe Insulation & vapor barrier shall be run continuously thru all wall and floors.

2.3 ROOF DRAIN PIPING – Existing & new as noted on drawings

- A. Roof drain receivers and roof drain piping (both primary and secondary) except in masonry wall and where buried in the ground, shall be insulated as specified for domestic cold water. Insulation thickness shall be 1".
- B. Roof drain piping and fittings running exposed in occupied public areas shall be covered with a white PVC cover.

2.4 REFRIGERANT SUCTION PIPING

- A. Refrigerant suction piping shall be insulated with 1-1/2" thick closed cell flexible foam. Insulation exposed to outside shall be finished with two heavy coats of U.V. resistant grey sealer.

2.5 WATER & WASTE PIPING EXPOSED BELOW LAVATORIES AND HANDICAPPED SINKS

- A. Insulate all exposed surfaces with an approved ADA insulation kit as required by sink manufacturer.

2.6 LOW PRESSURE ROUND DUCTS

- A. All round metal ducts shall be wrapped with 1" thick fiberglass duct wrap with factory-applied vapor barrier. All joints shall be sealed with mastic and taped to form a neat and complete insulation system.

PART 3 – EXECUTION

3.1 GENERAL

- A. The contractor shall provide a complete installation which is neat in appearance and functional.
- B. Remove all excess materials and packaging from job site.
- C. All insulation shall be continuous thru wall and ceiling openings and thru sleeves.
- D. Insulation on all cold surfaces where vapor barrier jackets are used will be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor-sealed to prevent condensation.
- E. Valves and fittings inside the building shall be insulated as specified for the piping systems and covered with high temperature P.V.C. insulation fitting covers.
- F. Fittings and valves for pipe size smaller than 4" shall be insulated and finished with Insulating and Finishing Cement to a thickness equal to the adjoining pipe insulation. Fittings and valves for pipe sizes 4" and larger shall be insulated with segments of the molded insulation secured with No. 20 gage galvanized annealed steel wire finished with a smoothing coat of finishing cement. Vapor seal with a layer of glass fabric embedded between two 1/16" coats of vapor seal adhesive. Lap seal outer jacket at least 1" on itself adjoining insulation.
- G. All terminations of insulation ends shall be tapered and covered with finishing cement.
- H. In exposed areas, all fittings shall be additionally finished with FSK wrap smoothly adhered. Overlap the FSK wrap on itself and adjoining pipe insulation. Overlap to be at least 1" on pipe insulation below 4" and 2" on sizes 4" and above.
- I. Insulation inserts and shields for cold surface piping such as roof drain lines and domestic cold water piping shall be installed at all pipe hangers. Inserts between the pipe and pipe hangers shall consist of calcium silicate block insulation of equal thickness to the adjoining insulation and shall be provided with vapor barrier where required. Insulation inserts shall not be less than the following lengths:

1/2" to 2-1/2" pipe size	6" long
3" to 6" pipe size	9" long
8" to 10" pipe size	12" long
- J. Rigid metal shields shall be applied between hangers or supports and the pipe insulation. Shields shall be formed to fit the insulation and shall extend up to the centerline of the pipe and length specified for the insulation hanger inserts.
- K. Vapor barrier wrap shall be sealed tight and not penetrated by the hanger or shield, and Finishing Cement, pre-sized glass cloth shall be smoothly adhered with Adhesive.
- L. Adhesives, mastics, and coatings shall be applied at the manufacturer's recommended minimum coverage per gallon.
- M. Where insulation pipes pass thru sound or fire-rated walls, floors, or ceilings, the insulation sleeves shall be sound or fire-rated to match rating of surface penetrated.

3.2 INSULATION WORKMANSHIP

- A. All insulation shall be applied by specialists experienced in the field and shall be neat in appearance. Neatness in appearance shall be equated to proper insulation application procedures, and sloppy workmanship will not be tolerated. Work which is deemed unacceptable shall be condemned, removed, and replaced at the contractor's expense.
- B. Protect floors, valve handle, accessories, etc., to keep paste off areas not being insulated.
- C. Splitting of longitudinal sections on flexible foam pipe insulation will not be permitted.
- D. Do not install insulation on pipes which require heat taping without coordinating with mechanical contractor.

3.3 CLEAN-UP

- A. The piping shall be cleaned and tested prior to installation of insulation.
- B. Fittings shall be cleaned after insulation is installed.

END OF SECTION

SECTION 23 0100 - GENERAL PROVISIONS

PART 1 – GENERAL PROVISIONS

1.1 GENERAL CONDITIONS

- A. The contractor shall carefully read the General Conditions of the Contract and all information to bidders which, with the following specifications for heating, cooling, plumbing, exhaust ventilation, and temperature controls are a part of the Contract.

1.2 BASIC BID

- A. Shall include all labor and materials specified in this division. The term "furnish" and/or "install" or similar implication shall mean "furnish and install complete."

1.3 SCOPE OF WORK

- A. The work to be done under this section includes the furnishing of all labor, materials, equipment, controls and accessories required to complete all heating, air conditioning, ventilating, plumbing, drainage, heat recovery, and other mechanical systems as shown on plans and/or described in these specifications, including miscellaneous items required to provide a complete and functional facility.
- B. Work shall include, but shall not be necessarily limited to, the following:
 - 1. System commissioning
 - 2. Testing
 - 3. Balancing
 - 4. Insulation systems
 - 5. Roof drain systems
 - 6. Air distribution system
 - 7. Exhaust systems
 - 8. Automatic control systems
 - 9. Air conditioning system
 - 10. Plumbing systems
 - 11. Special systems
- C. The mechanical contractor shall provide all miscellaneous electrical work and control wiring for special systems where the wiring requirements are provided by the equipment manufacturers and/or suppliers, unless all of the required wiring is clearly shown on the electrical drawings to be provided by the electrical contractor.

1.4 CODES AND ORDINANCES

- A. All work shall be installed in accordance with the city, state, and local plumbing codes, and all other codes, ordinances, and regulations which govern the type of work covered by these specifications.
- B. Should the drawings conflict with the code, the code shall govern the proper installation of the work, and no extra charge shall be made for such change.

- C. Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, or utility company regulations, he shall bear all costs arising in correcting the deficiencies.
- D. Where the work required by the drawings and specifications exceeds the minimum code requirements, the work shall be done as shown or specified.
- E. NOTE: Code compliance, or similar terminology, shall be interpreted to mean "the interpretation of the code as enforced by the local building authority".

1.5 DRAWINGS AND SPECIFICATIONS

- A. These specifications are intended to cover all labor, material, and standards of mechanical workmanship to be employed in the work shown on the drawings, called for in these specifications, or reasonably implied by terms of same. The drawings and specifications are intended to supplement one another, and any part of the work that may be mentioned in the one and not represented in the other shall be done the same as if it had been mentioned or represented in both.
- B. Large scale drawings shall take precedence over layouts and small-scale details.
- C. The mechanical drawings are schematic in nature, and show the general arrangement of all piping, ductwork, mechanical equipment, and appurtenances. They shall be followed as closely as the actual building construction and the work of other trades will permit.
- D. ACAD or Revit drawing files will not be provided to contractor for use. PDF's of sheets may be provided by request for coordination purposes.
- E. Due to tight structural conditions and space limitations in selected areas the contractor should anticipate structural and space conflicts and shall make allowances for them in his bid. Until the steel fabrication shop drawings are submitted for review, the mechanical coordination cannot be completed.
- F. The architectural and structural drawings shall be considered part of the mechanical work insofar as these drawings furnish this Division with information relating to design and construction of the building. Architectural and structural drawings take precedence over the general building layouts and details shown on the mechanical drawings.
- G. The structural engineer and architect shall approve all attachments to or modifications of any structural members in the building required for installation of the mechanical systems.
- H. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which will actually be required. This contractor shall investigate the structural and finish conditions affecting the work and provide all necessary offsets, fittings, valves, trim, and accessories required to meet actual job-site conditions.
 - 1. Dimensions -
Verify dimensions governing mechanical work at the building. No extra compensation shall be claimed or allowed on account of differences between the actual job-site dimensions and those indicated on the drawings.

2. Adjoining work -
Examine all adjoining work on which the mechanical work is dependent and report any work which must be corrected. No waiver of responsibility shall be claimed or allowed due to failure to report unfavorable conditions affecting the mechanical work.

1.6 INTERPRETATION OF DRAWINGS AND DOCUMENTS

- A. If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the plans, specifications, or other proposed contract documents, or finds discrepancies in or omissions from the drawings or specifications, he may submit to the Owner's representative, a written request for an interpretation or correction thereof. The person submitting the request will be responsible for its prompt delivery. Any interpretation or correction of the proposed documents will be made only by addenda duly issued, and a copy of such addenda will be mailed or delivered to each person receiving a set of such documents. The Owner will not be responsible for any other explanations or interpretations of the proposed documents. All questions shall be submitted at least seven days in advance of bidding.
- B. The Owner's representative will interpret the meaning of any part of the drawings and specifications about which any misunderstanding may arise, and his decisions will be final. Should there appear to be any error or discrepancy in or between the drawings and specifications, the contractor shall refer the matter to the Owner's representative for adjustment before proceeding with the work. Should the contractor proceed with the work without so referring to the matter, he does so on his own responsibility.

1.7 WORKMANSHIP

- A. Workmanship shall be the best quality of its kind for the respective industries, trades, crafts, and practices, and shall be acceptable in every respect to the Owner's representative.

1.8 SUBSTITUTIONS

- A. See Special Conditions pertaining to Substitutions.
- B. Requests for prior approval must be submitted to owner's representative a minimum of five working days prior to bid date.

1.9 FEES & PERMITS

- A. This contractor shall obtain all necessary permits and pay all fees required in connection with the work.
- B. Requirements of the local utility companies shall apply at the time of bidding. The contractor shall have checked with the local utility companies, and shall determine from them all valves, boxes, meter boxes, and meters which they will require to be installed, and shall figure cost of same in his bid. Utility connection fees will be paid by the Jordan School District.
- C. Division 22 & 23 contractor shall be responsible for fees and permits.
- D. Site utility contractor shall provide water meter and meter box as required by local water department.

1.10 SITE INSPECTION AND EXAMINATION OF DRAWINGS

- A. The contractor shall carefully study all drawings and specifications pertaining to the work. If any of the work as laid out, indicated, or specified is contrary to or conflicts with any governing ordinances or regulations, the same shall be reported to the Owner's representative before submitting a bid. The Owner's representative will then issue instructions as to the procedure.
- B. The contractor shall carefully examine the building site and compare the drawings with existing conditions. By the act of submitting a bid, the contractor shall be deemed to have made such examination, to have accepted such conditions, and to have made allowance therefore in preparing his bid.

1.11 VERIFICATION OF DIMENSIONS

- A. Before proceeding with any work, the contractor shall carefully check and verify all dimensions, sizes, etc., and shall assume full responsibility for the rigging and fitting-in of his ductwork, piping, and equipment. Where apparatus and equipment has been indicated on the drawings, dimensions have been taken from typical equipment of the class indicated. The contractor shall carefully check the drawings to see that the equipment he is required to install will fit into the spaces provided and will allow for proper maintenance and service of the equipment.

1.12 COORDINATION

- A. This contractor shall coordinate his work with other specification divisions and shall provide all necessary specialty items, trim, and incidental 115 volt and 24-volt power and control wiring (which is not shown or specified under other divisions) required to provide a complete functional acceptable system.
- B. The Division 22 & 23 contractor shall coordinate his work such that all slots and openings through floors, walls, ceilings, and roofs are properly located and shall do any cutting and patching caused by neglecting to do so.
 - 1. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into the construction as the work proceeds.
 - 2. It is the responsibility of Division 22 & 23 to locate these items and see that they are properly installed.
- C. The locations of all piping, ducts, apparatus, and equipment indicated on the drawings are approximate only, and shall be changed as required to meet the actual architectural and structural conditions at the job site. All changes shall be approved by the Owner's representative. Any change in work which has not been installed shall be made by the contractor without additional compensation, except changes which are caused by architectural and structural changes which substantially increase the size of any of the mains, or which substantially increase the number of fixtures or length of pipe runs. Any and all changes shall be made only upon approval of a written change order.
 - 1. Right of way - Lines which pitch shall have the right of way over those which do not pitch. For example, plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have right of way over lines whose elevations can be changed.

2. Offsets, transitions, and changes in direction in pipes and ducts shall be made as required to avoid conflicts with building footings and foundations or other buried ducts or utilities, and to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. Furnish and install all traps, air vents, sanitary vents, and devices as required to affect these offsets, transitions and changes in direction.
- D. It shall be each contractor's responsibility to verify exact location, elevation, and/or route of the various mechanical system components with architectural details and with Owner's representative's personnel on job.
- E. Where deviations from locations and/or arrangements described are necessary to meet actual job conditions, the changes shall be made without cost to the Owner.
- F. The Owner's representative reserves the right to make any reasonable change in location of any outlet, piping, or equipment, before installation, without additional cost.

1.13 LOCATION OF CEILING OUTLETS:

- A. This contractor shall assist the Owner's representative, General Contractor, Electrical Contractor and other interested parties in the establishment of room centerlines, axis of rooms and all walls.
- B. All grilles, registers, ceiling diffusers, etc. shall be located with reference to these established data points.
- C. These outlets shall be referenced to such features as room centerlines, walls and ceiling furrings, balanced border widths, etc.
- D. Outlets in acoustical tiles, panels, etc. shall occur in joints or centers of whole pieces, etc.
- E. The final determination of the exact location of all outlets shall be subject to the direction and approval of the Owner's representative.

1.14 PROVISIONS FOR REMOVAL & ADEQUATE CLEARANCE

- A. Install Mechanical work to permit removal of heating and cooling coils, filters, belt guards, sheaves, drives, and other parts requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
- B. Arrange pipes, ducts, and equipment to permit ready access to filters, valves, cocks, traps, starters, motors, control components, and to clear the openings of swinging doors and access panels.

1.15 RECORD DRAWINGS

- A. The contractor shall maintain one set of record drawings. These prints shall show the location, elevations and details of all items of work installed under this contract. Buried piping shall be located by dimensions from foundation walls and depths of bury shall be indicated. These shall be marked in red. The completed set of record drawings must be submitted to the Owner's representative before the contractor is eligible to receive the final payment. An up-to-date record set of drawings shall be maintained during the progress of the project and be available to the Owner's representative upon request.

1.16 COORDINATION DRAWINGS

- A. The contractor shall provide coordination drawings, when requested by the Owner's representative, to ensure that the various mechanical system components are coordinated with each other, and with other building systems.
- B. The coordination drawings shall be drawn to scale (usually 1/4" = 1'-0") and shall show all systems as they relate to each other, especially in areas of potential conflict.
- C. Equipment room coordination drawings shall include, in addition to the information specified, the size and location of all piping, pipe fittings, valves, strainers, specialties, flexible connections, water treatment devices, control panels, etc., and their installed elevation.
- D. Equipment room coordination drawings shall show the location of all pertinent electrical outlets, lights, panels, transformers and switch gear, and their required clearances from duct, piping, and equipment, and for maintenance access.
- E. Footing and foundation coordination drawings shall be prepared showing the exact location, depth, and slope of all buried piping to be installed. These coordination drawings shall include all sand and grease interceptors, drains in depressed slab areas, and all necessary buried water piping.
- F. This set of foundation coordination drawings shall be maintained in the construction trailer and shall be marked up daily to indicate exact location and elevation of all buried piping and conduit systems.
- G. Coordination drawings shall be professionally drafted and shall be clear and concise in their presentation and clarity.
- H. All coordination drawings shall be prepared in digital format in the latest version of Revit. Material shall be submitted in both printed and digital form.
- I. All ductwork and piping attachments to the building structure shall be detailed and shall be coordinated with the Owner's representative.

1.17 COOPERATION WITH OTHERS

- A. The contractor shall so organize the work that progress will harmonize with the work of all trades, so that all work may proceed as expeditiously as possible. The contractor shall be held responsible for any delays which might be caused by his negligence or failure to cooperate with other contractors or crafts.

1.18 FOREMAN

- A. A full-time foreman shall be designated by the contractor to the Owner's representative and shall be available on site for consultation. This individual, when appointed, will not be replaced without prior approval from the Owner's representative. The foreman shall be responsible for the coordination and correct placing of the work.

1.19 GUARANTEE

- A. By the acceptance of the contract award for the work herein described, the contractor assumes the full responsibility imposed by the guarantee as set forth herein and should protect himself through proper guarantee from equipment and specialty manufacturers and subcontractors as their interests may appear.

- B. All materials and equipment provided and installed under this division of the specifications shall be guaranteed for a period of one (1) year from the date of substantial completion and acceptance by the Owner, unless specifically noted elsewhere in the specification. Should any trouble develop during this period due to defective materials or workmanship, the contractor agrees to correct the trouble without any cost to the Owner, any defect noticed at the time of installation and/or during the guarantee period shall be corrected immediately to the satisfaction of the Owner.

1.20 SCHEDULES, MATERIALS AND EQUIPMENT

- A. As soon as practicable, and within 30 days after date of award of contract, and before commencement of work, a complete schedule of equipment and materials proposed for installation shall be submitted to the Owner's representative. The schedule shall include catalogs, cuts, drawings, and such other descriptive data or samples that are requested by the Owner's representative. Schedules shall include all items of equipment used. No partial submittals will be accepted.
- B. Provide corrected copies of each required shop drawing or similar submittal to the Owner's representative for review, approval, and return. DO NOT SUBMIT without the general contractor's signed stamp, indicating the general contractor has reviewed the submittal for completeness and conformance to the Contract Documents.
- C. Inform the Owner's representative by notation, or in the letter of transmittal, of any proposed deviation from the requirements of the Contract Documents.
- D. Provide required shop drawings or other submittals within time stipulated on approved progress schedule.
- E. Do not commence work requiring a shop drawing or other submittal until approval of the required submittal has been received. Such approval will be based upon a review only for conformance with the design concept of the project and with the information given in the Contract Documents and does not relieve the contractor from responsibility for errors or omissions in the shop drawings.
- F. Schedules shall be neatly bound in a digital format. Schedules shall be completely indexed, and shall include the following items:
 - 1. Circulators
 - 2. Valves
 - 3. Water heater
 - 4. Piping systems
 - 5. Pipe supports & restraints
 - 6. Rooftop units
 - 7. Unit heaters
 - 8. Pressure gauges & thermometers
 - 9. Plumbing fixtures
 - 10. Supply air fans
 - 11. Exhaust air fans
 - 12. Dampers
 - 13. Louvers
 - 14. Low pressure flexible ducts
 - 15. Grilles & registers
 - 16. Diffusers
 - 17. Fume Hood
 - 18. PRV stations

19. Insulation systems
20. Vibration isolators
21. Seismic restraints
22. Automatic temperature controls
23. Air balance contractor qualifications
24. System commissioning contractor's qualifications
25. Fire safety system with installation diagrams
26. Other schedule items

G. Submittals received which do not contain all of the above items will be returned unchecked.

H. Purpose and Contractor's Responsibility:

I. The purpose of the final submittal is to "assist the contractor in selecting the equipment." The contractor shall review the submittals prior to submission to the Owner's representative to make sure that the submittals are complete in all details including the following items:

1. Manufacturers' names shall be mentioned in specifications as accepted by Owner at time of bidding.
2. Equipment dimensions shall be verified to fit the spaces provided with sufficient clearances, as may be required by the equipment or indicated on the drawings.
3. Equipment shall be reviewed with respect to schedules, specifications, plans and details.
4. Equipment submittal sheets shall be clearly marked indicating equipment symbol and exact selection of proposed equipment.

J. Review:

Review and acceptance of submittal does not relieve the contractor of his responsibility to fulfill the contract requirements. Review and acceptance of the submittal will not be used as a means of changing the contract requirements. Items not covered in the accepted submittal, or items incorrectly covered but not recognized or identified, shall not be used when contrary to the requirements of the contract documents.

K. Acceptance of Substitute Equipment:

If the proposed installation is approved, this contractor shall make all incidental changes in piping, ductwork, supports, installation, wiring, heaters, panel boards, and as otherwise necessary. Provide any additional motors, valves, controllers, fittings, and other additional equipment required for the proper operation of the system resulting from the contractor's selection of alternate equipment, including all required changes in the effected trades.

L. Owner's Refusal Right:

In the event that items submitted are substitutions for specified items and are found to be not acceptable, the right shall be reserved to require the specified items.

1.21 OPERATING INSTRUCTIONS AND CATALOG INFORMATION

- A. This prime Division 23 contractor shall compile in digital format catalogs of every product used by him and subcontractors in the completion of the work. The manuals shall also include copies of the test data (Section 230501), balancing reports (Section 230593), and system commissioning data (Section 230800). Before final acceptance by the Owner's representative, he shall turn over to the Owner this compilation of catalog data. A double index shall be provided, one giving an alphabetical list of products for which catalogs are included, and one giving their addresses, whose products are included in the work. Provide data for each item of equipment listed in SCHEDULES, MATERIALS & EQUIPMENT, as shown in Section 230100. Provide copy of submittal data. All products shall be assembled by Division.
- B. One (1) digital copy shall be provided to the Owner's representative for their approval.
- C. Provide warranty schedule and schedule of overload protection as required in Section 230800.
- D. Manuals not in compliance will not be reviewed and will be rejected.
- E. Manuals shall be identified as follows: .

JORDAN LEARNING CENTER
JORDAN SCHOOL DISTRICT
OPERATING & MAINTENANCE MANUAL
2024 - 2025
SET #

PART 2 – PRODUCTS

2.1 MATERIALS, EQUIPMENT AND ACCESSORIES

- A. Unless otherwise specified, all equipment, accessories, and materials shall be new and undamaged, and the workmanship shall be of the best quality for the use intended and shall be acceptable to the Owner's Representative.
- B. Equipment, accessories, and materials shall be essentially the standard products of the manufacturer, or as specified herein. Where two or more units of the same class of new equipment are required, these units shall be products of a single manufacturer.
- C. Should mechanical equipment other than that used in the design be furnished, it shall be the responsibility of the mechanical subcontractor to provide large scale (1/2" = 1'-0") installation drawings, as required, showing service and maintenance points with proper clearance allowances for service.
- D. All equipment shall be selected to deliver full rated capacity at the job site elevation.

PART 3 – EXECUTION

3.1 FUNCTIONING AND OPERATION OF EQUIPMENT

A. Contractor's Responsibility:

Installation and startup shall be so made that its several component parts will function together as a workable system and shall be left with all equipment properly adjusted and in working order.

3.2 CLEANING AND PATCHING BY MECHANICAL CONTRACTOR

- A. The contractor shall remove all stains or grease marks on walls, floors, glass, hardware, fixtures, or elsewhere, caused by his workman or for which he is responsible. He shall remove all stickers on plumbing fixtures, do all required patching up and repair all work of others damaged by this division of the work, and leave the premises in a clean and orderly condition.

3.3 INSTRUCTIONS TO OWNER'S REPRESENTATIVES

- A. The mechanical contractor shall provide, without expense to the Owner, competent instructors to train the Owner's representatives in the care, adjustment, maintenance, and operation of all parts on the heating, air conditioning, ventilating, plumbing, and automatic temperature control systems and equipment. Training shall be a minimum of 36 hours with no less than 12 hours for ATC training.
- B. An additional 32 hours shall be provided by all mechanical sub-contractors to walk thru building with Jordan School District representative to verify operation of all Division 22, 23, & 25 items and control sequencing.
- C. An additional 8 hours of training shall be provided to the owner at the time of the 12-month warranty inspection.
- D. Instruction date shall be scheduled with the owner at the time of final inspection. A written report specifying times, dates, and name of personnel instructed shall be forwarded to the Owner's representative.
- E. No training shall begin until system commissioning is complete and accepted by the owner.

3.4 PROTECTION AGAINST THE ELEMENTS

- A. The contractor shall, at all times, take reasonable and adequate precautions to protect his work and all stored materials and equipment from damage by the elements, including flooding, windstorms, etc., and shall not expose the work of any other contractor to such damage.
- B. In addition to requirements specified in Division 01, stored material shall be readily accessible for inspection by the Owner's representative until installed.
- C. All items subject to moisture damage, such as controls, shall be stored in dry, heated spaces.
- D. Protect all bearings during installation, and thoroughly grease steel shafts to prevent corrosion.

3.5 REMOVAL OF DEBRIS, ETC.

- A. Upon completion of this division of the work, remove all surplus material and rubbish resulting from the work, and leave the premises in a clean and orderly condition.

3.6 MOTORS & STARTERS

- A. This contractor shall furnish all motors required and necessary to operate equipment furnished by him. The voltage, phase, and horsepower of each motor shall be coordinated with the electrical contractor prior to ordering.

3.7 OPENINGS FOR MECHANICAL SYSTEMS

- A. All openings required for installation of mechanical systems shall be provided by the mechanical contractor. Any piece of equipment which is to be installed in any space of the building and which is too large to permit access through stairways, doorways or shafts shall be brought to the job by the Contractor involved and placed in the space before the enclosing structure is completed. Materials shall be delivered at such stages of the work as will expedite the work as a whole.

3.8 SAFETY REGULATION

- A. The contractor shall comply with all local and OSHA safety requirements in performance with this work. (See General Conditions). This contractor shall be required to provide equipment, supervision, construction, procedures, and all other necessary items to assure safety to life and property.

3.9 OWNER FURNISHED EQUIPMENT

- A. This contractor shall include in his bid the necessary labor and material to properly coordinate and install the required piping, trim, specialties, controls, ductwork, and other necessary utilities and services to equipment furnished by the Owner.
- B. This contractor shall relocate (where noted), rough-in and make final connections to owner furnished equipment.
- C. See bid documents for a list of owner furnished equipment which is not otherwise identified on the mechanical drawings or in the mechanical division of the specifications.

END OF SECTION

SECTION 23 0501 - TESTING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The work outlined in this section shall be performed by the several trades involved.
- B. The mechanical contractor shall provide all supervision, labor, materials, tools, scaffolding, and equipment required to complete all system testing.
- C. The mechanical contractor shall remove and repair any defective component as indicated by the system tests and retest.
- D. The mechanical contractor shall test the operation of all safety and high limit controls to ensure proper installation and operation. Any defective devices shall be replaced.

1.2 TESTS AND ADJUSTMENTS

- A. Before any piping is covered, tests shall be made in the presence of the Owner's Representative, and any leaks or defective work corrected. No caulking of threaded work will be permitted.
- B. Before application of insulation covering, and as far as practical before concealing any piping, all piping shall be hydrostatically tested and proved tight.
- C. Stubs shall be capped, and all control valves shall be removed during the test.
- D. System may be tested in sections, providing connections to last section tested are included in each succeeding test.
- E. Following minimum pressures shall be used for testing:
 - 1. Natural gas piping at 150 psig for six hours.
 - 2. Domestic hot and cold-water piping at 150 psig for six hours.
 - 3. Plumbing waste and vent piping at 10 ft. head for six hours.
 - 4. Rainwater piping at 10 ft. head for six hours.
 - 5. Low pressure air ducts in accordance with SMACNA standards
 - 6. Fire protection system piping at 150 psig for six hours
 - 7. Refrigerant piping as required in 230900.
- F. All valves and equipment which may be damaged shall not be subjected to the test pressure.
- G. 230501 contractor shall perform all duct pressure tests per specifications and owner requirements.

PART 2 – PRODUCTS

2.1 EQUIPMENT

- A. The contractor shall furnish all necessary gauges, plugs, test fans, pumps, etc., as required to conduct the tests.

2.2 REPORTS

- A. The contractor shall give the Owner's Representative one-week notice prior to performing the tests. All tests shall be recorded, and copies of reports bound in the O & M manuals and given to the Owner.

PART 3 – EXECUTION

3.1 PROCEDURE

- A. The contractor shall be responsible for conducting all tests in a safe manner, protecting the work of other trades from water or physical damage.
- B. The tests, as indicated, shall be in addition to any test, as required, by any governing agency. Submit all approved tests, as required, by any governing agency to the Owner's representative.
- C. Each test and any necessary repairs and retest shall be performed by the contractor which installed the system.
- D. Upon completion, a test shall demonstrate that the culinary hot water system is circulating, that all traps are properly vented, that there is an ample supply of hot and cold water to fixtures, that no fixture or equipment can be back siphoned, and that there are no back-flow connections.

END OF SECTION

SECTION 23 0593 - BALANCING

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. The mechanical contractor shall employ an independent technical firm to perform the checking, adjusting, and balancing (CAB) of the HVAC systems. This firm shall be one whose operations are limited to the field of professional CAB, and this firm shall meet the following qualifications:
 - 1. The firm shall be a member of AABC and/or NEBB.
 - 2. The firm shall be one which is organized to provide professional services of this specific type.
 - 3. The firm shall have completed projects of similar scope within the past 12 months and shall be capable of performing the services specified at the location of the facility described within the time frame specified and following up the basic work as may be required.
 - 4. All personnel used on the job site shall be engineering technicians, who shall have been permanent, full-time employees of the firm for a minimum of six (6) months prior to the start of the work for this project.
 - 5. **Preferred contractors shall be Certified Test & Balance, Independent Test & Balance, BTC Services, RS Analysis and Bonneville test & Balance.**
- B. As a part of this contract, the mechanical contractor shall make all changes in the sheaves, belts, and dampers, including the addition of dampers required for correct balance as required by the CAB firm, at no additional cost to the Owner.
- C. The mechanical contractor shall provide, and coordinate services of qualified, responsible subcontractors, suppliers, and personnel as required to correct, repair, or replace any and all deficient items or conditions found during the testing, adjusting, and balancing period.
- D. In order that all systems may be properly checked, balanced, and adjusted as required by these specifications, the mechanical contractor shall operate said systems at his expense for the length of the time necessary to properly verify their completion and readiness for the CAB and shall further pay all costs of operation during the CAB period.
- E. The project completion schedule shall be coordinated with the CAB work to provide sufficient times to permit the completion of CAB services prior to Owner occupancy.

1.2 DOCUMENTS

- A. The Owner's representative will furnish, without charge to the CAB firm, one set of mechanical specifications, all pertinent change orders, and the following:
 - 1. One complete set of plans less the structural sheets.
 - 2. One set of mechanical floor plans of the conditioned spaces.
- B. Approved submittal data on equipment installed to accomplish the test procedures outlined in paragraph "Services of the CAB Firm" of this specification will be provided by the mechanical contractor.
- C. The Owner's representative will transmit one copy of the following "Records for Owner" to the CAB firm for review and comments:

1. Record drawings
2. Approved fixture brochures, wiring diagrams, and control diagrams.
3. Shop drawings
4. Instructions
5. Motor and valve charts
6. Operating and Maintenance Manuals

1.3 SERVICES OF MECHANICAL CONTRACTOR

- A. The mechanical contractor shall have all systems complete, calibrated, and in operational readiness prior to notifying the CAB firm that the project is ready for their services. The mechanical contractor shall coordinate system readiness with the system commissioning contractor and shall certify in writing to the Owner's representative that the system is complete and ready to balance.

1.4 SERVICES OF THE CAB FIRM

- A. The technical CAB firm shall submit biographical data on the individual proposed to directly supervise the CAB work. It shall also submit their record of specialized experience in the field of air and hydronic system balancing.
- B. Act as liaison between the Owner's representative and contractor and periodically inspect the installation of mechanical piping systems, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems as the installation progresses. The inspection will cover only those parts of the systems relating to the checking and balancing.
- C. To check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building.
- D. Prepare and submit to the Owner's representative, complete reports on the balance and operations of the systems.
- E. The CAB firm shall be responsible for inspecting, adjusting, balancing, and logging the data on the performance of the following general systems, including all components.
 1. Heating systems, including rooftop units, controls, etc.
 2. Cooling systems, rooftop units, coils, controls, etc.
 3. Freon compressor systems, including chillers, coils, controls, etc.
 4. Temperature control system in its entirety includes the verification of all control sequences and safety devices.
 5. Domestic hot water re-circulating systems.
- F. Before any adjustments are made, the air systems are to be checked for such items as dirty filter, duct leakage, damper leakage, equipment vibrations, correct damper operations, etc.
- G. Before any adjustments are made to water systems, the strainers shall be cleaned, temperature control valve operation shall be checked, pump rotation shall be checked, pressure reducing valves shall be adjusted, etc.

- H. It shall be the responsibility of the CAB personnel to check, adjust, and balance the components of the various systems as listed above using an applicable "proportionate balance procedure" in order that each of them will operate under optimum noise, temperature and air flow conditions in the conditioned spaces in the building "while simultaneously operating at the most energy efficient condition."
- I. During the balancing process, if abnormalities or malfunctions of equipment or components are discovered by the CAB personnel, the owner's representative shall be advised promptly so that the condition may be corrected by the project contractor. Data from malfunctioning equipment or components shall not be recorded in the final CAB report.
- J. Provide a minimum of 32 hours to coordinate with and assist Owners Independent Commissioning Agent as required.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND INSTRUMENTS

- A. This contractor shall provide all necessary labor, equipment, scaffolding, instruments, and materials required to adjust, balance, and check all systems.

PART 3 – EXECUTION

3.1 REPORT

- A. The activities, as described hereinbefore, will culminate in a report to be provided to the Owner's representative. This report shall be furnished in six (6) copies. One copy shall be bound in each O & M manual. The intent of the final report is to provide a reference of actual operating conditions for the building operating personnel.
- B. The CAB report shall include the following as a minimum:
 - 1. Preface:
A general discussion of the systems, any idiosyncrasies, any problems encountered, an outline of normal sequence of operation for the HVAC system cycles, any un-corrected noise problem.
 - 2. Pitot Tube Traverses:
For use in future trouble-shooting by maintenance personnel, all exhaust ducts, main supply ducts and return ducts will have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations will be described on the sheet containing the data.
 - 3. Temperature Tabulation:
Of all conditioned spaces on a room-by-room basis, a total of at least three readings will be taken of each room on successive days. Record outside ambient temperature at two-hour intervals. The total variation in conditioned space temperatures shall not exceed 2 deg. variance from the thermostat settings.

4. Air Volumes and Velocities:
As measured at each supply grille, return air grille, and exhaust air grille or air handling device. In all fan systems, the air quantities indicated on the plans may be varied as required to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the contractor to furnish or revise fan drive and/or motors, if necessary, without cost to the Owner, to attain the specified air volumes.
 5. Air Pressure:
As measured across each supply fan, cooling coil, heating coil, air handling unit filter and exhaust fan. Relate these readings to the particular fan curve in terms of CFM handled at the various static pressures, and their relationship to fan power and fan instability.
 6. Electrical Current/Voltage:
Measurements to be taken at the drive motor on each piece of equipment.
 7. Fan Speeds:
To be measured in RPM.
 8. Instrumentation List:
A list of instruments by type and make used in gathering the CAB data.
 9. Drawings:
The CAB contractor's working drawings shall have the VAV, and supply air openings numbered and/or lettered to correspond to the numbers and letters used on the report data sheets so that data in the report can be correlated with each specific supply air opening in the building. If room numbers actually used in the building differ from those on the plans, the building room numbers shall be marked on these plans. Only one such marked-up set of drawings need be provided with the six copies of the CAB report.
- C. Before final acceptance of the CAB report, the report data, at the discretion of the Owner's representative, shall be verified one time on the job site, by selection of check points (not to exceed 10 percent of total) at random, in the presence of the Owner's representative. Representatives of the testing firm doing the work shall be present and provide the necessary equipment for test data verification.
 - D. The firm shall be responsible for inspecting, adjusting, balancing, and logging the data on the performance of fans, all dampers in the duct system, all air distribution devices, the flows of freon or water thru all coils, and the power consumption of all motors.
 - E. During the CAB work, the temperature regulation will be adjusted for proper relationship between controlling instruments. The Owner's representative will be advised of any instruments out of calibration so that the controls subcontractor may come in and recalibrate, using data supplied by the balancing firm.
 - F. Make a total of three inspections within ninety (90) days after occupancy of the building to ensure that satisfactory conditions are being maintained throughout and to satisfy any unusual conditions.
 - G. An additional inspection in the building shall be made by the firm during the season opposite that in which the initial adjustments were made. At that time, any necessary modifications to the initial adjustment required to produce optimum operation of the system components shall be made to produce the proper seasonal conditions in each conditioned space.

- H. At the time of opposite season checkout, the Owner's representative shall be given timely notification before any readings or adjustments are made so that they may participate in the checkout.

END OF SECTION

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SECTION 23 0800 - SYSTEM COMMISSIONING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The work required under this section shall include, but not necessarily be limited to, the following:
- B. The pre-startup inspection of all systems by installing contractor and coordinating of the subsequent correction of any incorrect items.
- C. Repair, replacement, or adjustment of each item shall be performed by the installing contractor.
- D. System operations inspection.
- E. The contractor shall be required to provide a detailed report verifying proper operation of all equipment and devices, correct control sequences for all systems and proper air and water flow for systems throughout the building.
- F. The installing contractor shall act as liaison between the Owner's representative and Owners Independent commissioning contractor and periodically inspect the installation of mechanical piping systems, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems as the installation progresses.
- G. Verification of proper systems start-up, installation and ATC sequence shall be demonstrated to JSD representative prior to request for final inspection of systems.
- H. An additional 12 hours of commissioning shall be provided by the installing contractor to be used as required by the owner at the time of the 12-month warranty inspection.
- I. The intent of this section is to provide for proper installation, startup, service, and operation of the mechanical systems in preparation for system balancing. See Section 230593 for balancing.

1.2 PRE-STARTUP INSPECTION

- A. The pre-start-up inspection of all systems shall provide for verifying that each piece of equipment is properly installed and prepared for startup.
- B. All pertinent items shall be checked, including, but not necessarily limited to, the following:
 - 1. Removal of shipping stops.
 - 2. Vibration isolators and seismic snubbers properly aligned and adjusted.
 - 3. Flexible connections are properly aligned.
 - 4. Belts are properly adjusted.
 - 5. Belt guards and safety shields are in place.
 - 6. Safety controls, safety valves, and high or low limits are properly installed and functioning.
 - 7. All systems are properly filled.
 - 8. Filters are in place with a proper seal around their edges.
 - 9. Fire dampers are properly installed, linked, and serviceable.
 - 10. Pressure and temperature gauges of the proper size and range are installed.
 - 11. All test stations and measuring devices are properly installed and functioning.

12. Initial lubrication of equipment is complete.
13. Filters and strainers are clean.
14. Motor rotations are correct.
15. Voltages match nameplates.
16. Control system is operating properly.
17. All interlocks are wired and verified.
18. All controls have been connected and verified.
19. All valves, dampers, and operators are properly installed and operating.
20. All ductwork is installed and connected.
21. All roof-mounted equipment is properly flashed.
22. All water piping is either heat taped or located in spaces which are heated to prevent freezing.
23. Piping which is run above the roof or is otherwise subjected to freezing is properly heat taped and insulated.
24. All other items necessary to provide for proper start-up.
25. All seismic restraints are in place and secured.
26. All condensate drain lines are piped to discharge in proper drains.

1.3 FIRST RUN INSPECTION

- A. Recheck all items outlined in pre-startup inspection to insure proper operation.
- B. Check the following items:
 1. Excessive vibration or noise.
 2. Loose components.
 3. Initial control settings.
 4. Motor amperages.
 5. Heat buildup in motors, bearings, etc.
 6. Control system is sequencing properly, calibrated and functioning as required.
 7. Heat tapes are wired & functioning.
- C. Correct all items which are not operating properly.

1.4 SYSTEM OPERATION INSPECTION

- A. The mechanical systems shall be observed by the owner under operation conditions for sufficient time to insure proper operation under varying conditions, such as daylight and heating-cooling.
- B. Periodically check the following items:
 1. Strainers and filters.
 2. Visual check of air flow for "best guess" setting for preparation for system air balancing under Section 230593.
 3. Control operation of time clocks, on-off sequences, system cycling, etc.
 4. Visual checks for water flow, seals, packings, safety valves, operating pressures and temperatures.
 5. Cleaning of excessive oil or grease.
 6. Dampers close tightly.
 7. Valves close tightly.
 8. System leaks.

9. All other items pertaining to the proper operation of the mechanical system, whether specifically listed or not.

1.5 WARRANTY SCHEDULE

- A. Provide a list in each O & M Manual of all motors, fans, and equipment with manufacturer's names, models, serial numbers and date of startup approved by the Owner's representative, date of warranty, extent of warranty, and equipment supplier with address and phone numbers.

1.6 SCHEDULE OF OVERLOAD PROTECTION

- A. Provide a list in each O & M Manual of all motors with size, voltage, amperage, and size and rating of overload protection.

1.7 REPORT

- A. Prior to the start of system balancing the installing contractor is required to submit a detailed written report to the owner's representative outlining the results of the installation and start-up of all systems and piece of equipment which lists any un-corrected system abnormalities.

1.8 CERTIFICATION

- A. Provide written certification of all tests, and start-up procedures. Bind a copy of this certification in the O & M manuals. Certification shall include an itemized list of systems serviced during the system commissioning process with dates, times, and a complete description of the work completed, and the name of the responsible system commissioning mechanic.

1.9 BUILDING OPERATION DEMONSTRATION

- A. Contractor shall include as a part of their bid an additional 40 hours for all Division 22 & 23 sub-contractors to demonstrate to building owner, and/or owner's representative that proper installation, operation, air and water balance, control, and system commissioning has been completed properly for all equipment, material or systems provided and/or installed by Division 22 & 23 contractor.
- B. All systems shall be verified in their entirety and all items resolved prior to this demonstration. This demonstration does not replace the owner training requirements.

END OF SECTION

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SECTION 23 0900 - BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section specifies the basic materials and methods to be used in Division 21, 22, 23 & 25 work.

1.2 MATERIALS & EQUIPMENT

- A. All materials shall be new and undamaged. Protect all stored materials and equipment from damage by the elements, including exposure to excessive heat, flooding and rain, windstorms, etc.
- B. All materials and equipment shall be installed in strict compliance with the manufacturer's recommendations.

1.3 CUTTING AND PATCHING

- A. Any cutting, patching, or filling necessary for the proper execution of this work, except as noted in the drawings, shall be done by this contractor.
- B. No rough or unsightly work will be allowed. Cutting of structural members shall be done only on approval of the Owner's representative.
- C. The attention of the contractor is directed to the requirements of running pipes thru concrete slabs, walls, and beams. These conditions are to be anticipated and sleeves installed as provided for under "Sleeves".

1.4 INSERTS

- A. Furnish and set, in all necessary locations, before or during construction, unistrut inserts for use in connection with the support and seismic restraint of piping, ductwork, and equipment furnished under this division of the work.

1.5 SLEEVES

- A. Sleeves for Concrete or Masonry Surfaces:
 - 1. **For pipes passing thru masonry or concrete construction, provide sleeves at least two pipe sizes larger than the pipe passing thru and made from sections of steel pipe.**
- B. Provide galvanized iron sleeves with collar on each side of wall for all ducts passing thru masonry or concrete construction.
- C. Provide 22-gauge sheet metal collars on each side of wall for all ducts passing thru gypsum wall construction or similar construction.
- D. Sleeves shall be placed in structural members only where approved by the Owner's representative.

- E. Sleeves through foundation walls below grade shall be mechanical seal type with watertight sealing grommets and pressure rings. Sealing grommets shall be non-melting at temperatures incurred. Foundation wall sleeves shall be "O.Z. Type WSK".

- F. Sleeves thru Finished Surfaces:

For pipes passing thru finished partitions or ceilings, provide galvanized sheet iron sleeves of suitable size. The sleeves shall be fastened to construction to prevent creep along pipe and the sleeve ends shall be flush with finished surfaces. Provide escutcheon plates at each side of finish wall or floor or ceiling for all pipes passing thru same.

- 1. Sleeves thru Fire-rated Surfaces:

All pipe sleeves and ductwork penetrating fire walls and surfaces shall be packed inside after pipes and/or ducts have been placed with a U.L. listed fire safing system. Contractor shall submit to the Owner's representative for review and approval specific installation diagrams showing exact method(s) to be used.

- 2. Sleeves thru Sound Rated Surfaces:

All pipe sleeves and ductwork penetrating sound rated walls or surfaces shall be packed with dense fiberglass, sealed with duct sealer and fitted with metal cover flanges on both sides.

- 3. Sleeves thru Floors:

Sleeves thru floors above grade shall extend 1" above the floor and shall be sealed watertight with waterproof silicone caulking.

- G. **All penetrations must be sleeved or core drilled/cut. Hammer drill is not an acceptable means.**

1.6 SAW CUTTING OF EXISTING FLOOR SLAB

- A. All saw cutting of the existing floor slab for demolition of existing piping, or installation of new piping shall be coordinated with all trades and project architect.
- B. Existing piping shall be field verified prior to any saw cutting.

1.7 PIPING & DUCTWORK SUPPORT

- A. Steel roof deck shall not be used to support loads from plumbing, HVAC ducts, light fixtures, architectural elements or equipment of any kind, unless specifically noted otherwise. Lightweight suspended acoustical ceilings with a total weight per wire not exceeding 50# may be hung from the steel roof deck. The hangers should be staggered to distribute the load over multiple deck flutes.
- B. Bracing of miscellaneous items (mechanical, electrical, plumbing, etc.) to the bottom chord of joists or girders will not be allowed in any instance. All lateral braces must connect to the top flange/top chord of the framing member above unless noted otherwise on the structural drawing.
- C. It is essential that all piping be supported from roof structure at joist within 6" of panel point location and from top or bottom chord of floor or roof joist.
- D. Beam clamps shall not be used to hang piping from open web joist, trusses or girders.
- E. All locations shall be reviewed and approved by the GC & Structural Engineer prior to installation.

1.8 PIPE LOCATION AND ARRANGEMENT:

- A. No water supply piping inside the building shall be placed in direct contact with the earth. Buried water piping shall be placed in split tile or PVC pipe below the 4" of gravel to keep pipe from direct contact with ground.
- B. Unless otherwise noted on the drawings, all water piping shall be kept out of concrete floor slabs.
- C. Under no circumstances shall plastic piping or ducting materials be run inside of supply or return air plenums.
- D. All piping shall be properly racked and supported to run straight and true.
- E. All changes in direction shall be made with approved fittings. Pipes shall not be bent to change direction.
- F. All piping shall be racked and run to facilitate maintenance work. Under no circumstances shall valves, shock absorbers, drip traps, or piping specialties be installed in a "closed space" without proper access provided for future maintenance. See "Access Doors" section of specifications.
- G. NOTE: All piping shall be capped or plugged at the end of each work shift and when not being extended, to prevent the entry of rocks and debris.
- H. Any pipe lines that are broken or disconnected, they shall be capped immediately after flushing to remove rock and debris from pipes. If rocks or other foreign materials are found in the system after it has been closed, the contractor shall stand the expense of their removal.
- I. All valves, piping, and equipment to be installed so as to permit disassembly for maintenance purposes.
- J. Provide drain valves at all low points in piping systems. Run to floor drain where possible, otherwise provide 3/4" hose connection with vacuum breaker.

1.9 VERIFICATION OF INSTALLATION

- A. At time of final inspection contractor shall provide a color video tape of all existing, new 3" and larger buried storm sewer and sanitary sewer lines both inside and outside to 5'-0" beyond the building line.
- B. Video must be taken after installation is complete to ensure that line is installed properly with no low spots, separations, etc. Video shall also ensure that all connections have been made properly and that no debris remains in piping system. The building owner shall be notified to witness video.
- C. Provide final digital video. Video quality must be able to distinguish all pipe joints, turns, fittings, etc. to assure pipe system is clean, connected properly and no low spots.
- D. All areas shall be clearly identified on video to directly relate to project 'Record Drawings'

1.10 PIPE JOINING

- A. **All steel pipe under 2" in size shall be joined by screwed connections. Piping shall be welded if pipe size is over 2" in size.**

- B. Welded ends shall be plain beveled. Welding fittings must be employed if welding is used. Small (1-1/2" and smaller) branch connections may be made with Weldolets or Thredolets provided the main is at least 2" dia., and not less than two pipe sizes larger than the branch. Where these connections are used, the pipe opening in the main shall be cut to insure a full inside pipe diameter at the branch connection. Slag and spelter resulting from the hole cutting shall be removed from the main piping.
- C. All joinings shall be made to maintain the full metal strength of the pipe, with neat and workman like appearance.
- D. All piping must be perfectly clean before the system is filled.
- E. Copper Piping in Domestic Water Service: Piping shall be cut (with a pipe cutter) so ends are square and will "bottom" in fittings. There must be no gaps left thru which solder can run into the line. If a hack saw must be used, it shall be guided with a miter box to ensure a square, even cut. Tubing shall be reamed to remove burrs, being careful not to expand tubing while reaming.
- F. The outside of the copper pipe and the inside of the fittings, where solder will be applied, shall be burnished with fine crocus cloth or fittings brushes until all dirt and oxide is removed.
- G. A light coat of soldering flux shall be applied to both pipe and fittings. Acid flux shall not be used.
- H. Joints in copper pipe shall be uniformly heated to proper soldering temperature to ensure that solder will flow to all parts of the joint. The solder shall be fed to the joint until a uniform line of solder appears around the pipe at the end of the fittings.
- I. Copper piping used in domestic water service shall be joined with 'Stay-Safe-50' or 'Silvabrite-100' no lead solder.
- J. When valves are being installed in copper piping, the non-metallic parts shall be removed to prevent the heat of soldering from damaging the valves. No heat shall be applied near where an excessive temperature may cause damage.
- K. All domestic copper piping 3" and larger shall be brazed.
- L. Qualification of Welders: Welders performing work under this Contract shall be certified and qualified in accordance with tests prescribed by the National Certified Welding Bureau (NCWB) or by other approved test procedures using methodology and procedures covered in the ASME Boiler and Pressure Vessel Code, Section IX, "Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators."
- M. Submit for approval the names, identification, and welder's assigned number, letter or symbol of welders assigned to this project.
- N. The assigned identification symbol shall be used to identify the work of each welder and shall be indelibly stamped immediately upon completion of each weld.
- O. Welders shall be tested and certified for all positions.
- P. Submit identifying stenciled test coupons made by each operator.
- Q. Any or all welders may be required to retake welding certification tests without additional expense. When so requested, a welder shall not be permitted to work as a welder on this project until he has been recertified in accordance with NCWB.

- R. Recertification of the welder shall be made after the welder has taken and passed the required tests.
- S. Where piping 1-1/2 inches and smaller is to be butt or socket welded, submit 3 samples of test welds for approval.

1.11 SCREWED CONNECTIONS

- A. All pipe shall be reamed at the ends and free of all inside scale or burrs. Threads shall be cut clean and sharp, and to a length equal to 1-1/8 the length of the female thread receiving the pipe. The pipe shall be screwed in the full length of the female thread.
- B. Pipe shall be made tight with teflon thread tape or thread lubricant worked into male thread only. Surplus material shall be wiped off and the joint left neat and clean. Lubricant shall be powdered graphite and linseed oil, or plumbage and linseed oil.

1.12 PIPE GRADING

- A. Piping shall be uniformly graded in direction of flow as noted below:

PIPING	FALL/RISE	DIRECTION	PER/RUN
Rainwater	1"	Down	8'
Water	1"	Up	40'
Waste - 4" & smaller	1"	Down	4'
Vent	1"	Up	4'
Condensate Drip	1"	Down	4'
Natural Gas	1"	Down	40'
Compressed Air	1"	Down	40'
Refrigerant	1"	Down	40'

1.13 EQUIPMENT BASES

- A. Pumps, tanks and other equipment shown on the plans shall be set on 4" high concrete pads. The pads shall be furnished as indicated on plans. The mechanical contractor shall coordinate pad size and location with the general contractor.
- B. Roof curbs shall provide a free height from the roof membrane to the top of the curb of at least 14" minimum. All roof curbs and platforms shall have a wood nailer strip around the top perimeter for securing the roof membrane and attaching roof flashings. All equipment mounted on roof curbs shall be installed level. Flashings by Division 7.
- C. Roof curbs shall be attached to building structure as required by the IMC and local codes.

1.14 VIBRATION ISOLATION

- A. All mechanical equipment over 5 H.P. shall be isolated in accordance with Table 34, Chapter 42, in the 2021 ASHRAE Handbook.
- B. Care shall be taken by this contractor to prevent the transmission of vibration from equipment to building structure. Flexible connectors shall be installed in all piping connecting to pumps, air handling units, cooling towers, and other flexibly mounted equipment.

- C. Flexible connection shall be specifically designed to absorb noise and vibration and to prevent damage to equipment caused by piping stress. Unit construction shall consist of heavy bellows type neoprene rubber hose sections with stainless steel liners and attachments to match piping.

PART 2 – PRODUCTS

2.1 PIPING SYSTEMS

- A. All piping shall be in accordance with the American Society for Testing and Materials, ASTM A-53. No foreign made piping or connectors will be accepted in this construction.
- B. Culinary cold, hot, and recirculating hot water above grade shall be Type "L" copper with soldered wrought copper fittings. Pull-T type fittings on copper piping are not allowed.
- C. All rainwater buried waste and vent piping below slabs shall be standard weight DWV schedule 40, solid core PVC ASTM F 1488 piping.
- D. Rainwater and waste and vent piping above grade shall be standard weight cast iron pipe with no-hub, tyseal, M-G, or A.B.I. 'Best' gasketed fittings for sizes 2" and larger; and galvanized Schedule 40 with tarred Durham drainage fittings for 1-1/2".
- E. All cast iron pipe and fittings, above ground, shall bear the collective trademark of the Cast Iron Soil Pipe Institute, or have prior approval of the engineer.
- F. Rainwater and waste piping above grade shall be standard weight cast iron pipe with no-hub, tyseal, M-G, or A.B.I. 'Best' gasketed fittings for sizes 2" and larger; and galvanized Schedule 40 with tarred Durham drainage fittings for 1-1/2".
- G. Condensate drip lines shall be Type "M" copper with soldered wrought fittings.
- H. Gas lines shall be Schedule 40 black steel pipe. Fittings shall be standard black malleable screwed, or standard welding fittings where welding is required. All gas lines shall be installed in strict compliance with the local fuel supply company requirements. Buried piping shall be coated or wrapped.
- I. Gas lines below slab shall be corrugated stainless steel tube (CSST). All gas lines shall be installed in strict compliance with the local fuel supply company requirements. Piping below slab to be encased in a Schedule 40 PVC pipe with long sweep elbow. Casing to terminate 1" above slab. PVC casing to be two pipe sizes larger than carrier pipe but be 2" minimum.
- J. Gas lines located outside building and below finished grade shall be ASTM D2513 polyethylene plastic pipe. Fittings shall be ASTM D2513 polyethylene, butt-fusion type; and ASTM D2683, polyethylene socket-fusion type. Installation and piping material shall be in strict compliance with the local fuel supply company requirements.
- K. Refrigeration piping shall be Type "L" copper with malleable copper fittings. Piping shall be specifically treated and sealed for refrigeration systems piping, similar to Mueller.
- L. NOTE: Pre-charged line sets will be permitted on refrigeration systems with rated capacities below 65,000 BTUH.
- M. All fire sprinkler piping shall be schedule 40 black steel. All piping and fittings shall be U.S. manufacture. Thin wall and schedule 40 equivalent piping will not be allowed.

- N. **Horizontal waste piping from urinals shall be schedule 40 solid core PVC epoxy coated piping.**

2.2 HANGERS AND SUPPORTS

A. Vertical Piping:

Attachment - Vertical piping shall be secured at sufficiently close intervals to keep the pipe in alignment and to carry the weight of the pipe and contents. Stacks shall be supported at their bases, and if over two (2) stories in height at each floor by approved metal floor clamps.

- B. Cast iron soil pipe shall be supported at not less than each story height and at its base.

- C. Screwed pipe (IPS) shall be supported at not less than every other story height.

- D. Copper tubing shall be supported at each story for piping one and one-half (1-1/2) inches in diameter and at not more than six (6) foot intervals for piping one and one-quarter (1-1/4) inches in diameter and smaller. Piping shall be wrapped with three wraps of vinyl tape to isolate pipe from ferrous pipe supports.

E. Horizontal Piping:

Under no circumstances shall piping be supported from the metal roof deck.

- F. It is essential that all piping be supported from top chord of roof structure at joist panel point locations. Coordinate with structural requirements.

- G. Supports - Horizontal piping shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

- H. Cast Iron Soil Pipe - Where joints occur, soil pipe shall be supported at not more than 5-foot intervals, except that where 10-foot pipe lengths are used, supports at 10-foot intervals are acceptable. Supports shall be placed within eighteen (18) inches of the hub or joint. No-hub joints and fittings shall be restrained with rods and clamps per manufacturer's recommendations.

- I. Screwed pipe (IPS) shall be supported at approximately 12-foot intervals.

- J. Copper tubing shall be supported at approximately 6-foot intervals for piping one and one-half inches and smaller in diameter and at 10-foot intervals for piping two inches and larger in diameter.

- K. Piping placed underground shall be laid on a firm bed for its entire length.

- L. Hangers shall be Grinnell Figure 260 for both bare and insulated pipe.

- M. Where roller type supports are used, they shall be chair type or suspension type, as required. (Provide carbon steel pipe saddles on insulated pipes).

- N. Where piping is run adjacent to walls or steel columns, it shall be supported from steel brackets or vertical channel hangers. Brackets shall be Grinnell Figure PS 732 or PS 3282 as directed, or approved substitute. Channel systems shall be approved for each condition on an individual basis.

- O. Furnish all hangers, inserts, brackets, anchors, guides, sliding supports, etc., and all auxiliary steel necessary for the installation. All supports shall be designed in accordance with the AISC Steel Handbook and painted with one shop coat of primer paint.

- P. Insulation inserts and shields for cold surface piping will be provided under Section 15180 of these specifications.
- Q. Optional cold surface piping support/shield.
 - 1. KLO-SHURE strut mounted insulation coupling with strut clamp. Anvil or approved equal.
- R. Pipe covering protection saddles shall be installed at all pipe hangers which support insulated "hot surface" piping. Saddles shall be tack welded to the piping and shall match the insulation thickness applied.
- S. All copper, fiberglass, or plastic piping shall be securely supported from the building structure at intervals specified and/or as recommended by the pipe manufacturer. Hanger shields for suspended piping shall be functionally similar to isolators with Grinnell Fib. 97. Non-ferrous piping shall be isolated from contact with ferrous supports with three wraps of vinyl tape.
- T. All piping in mechanical equipment rooms shall be supported with vibration control hangers.
- U. Plumbers' tape, chain, or wire will not be permitted for pipe support.

2.3 VALVES AND STRAINERS

- A. All valves and strainers shall be by one manufacturer. Approved valve manufacturers are Crane, Stockham, W. C. Norris, Grinnell, or Powell. Crane numbers are used for convenience.
- B. Domestic Hot and Cold Water:
- C. Gate Valves:

Valves 2" and smaller shall be Crane No. 428, bronze, screwed, 200# WOG gate valve with solid wedge disc and rising stem.
- D. NOTE: If unable to use a rising stem valve because of insufficient clearance, use a Crane No. 438 non rising stem valve.
- E. Globe Valves:

Valves 1-1/2" and smaller shall be Crane No. 37, bronze, screwed, 200# WOG globe valve with a replaceable teflon disc and teflon packing. The disc shall be suitable for hot water up to 360 deg. F. at 150 psi.
- F. Check Valves:

Valves 1-1/2" and smaller shall be Crane No. 37, bronze, screwed, Y-pattern 200# WOG swing check valve. Valves 2" and larger shall be Crane No. 373.
- G. Butterfly Valves:

Valves 2-1/2" and larger shall be Crane No. 23N-BRB iron body and disc, lug type, stainless steel stem, 200# WOG EPT Nordel seat rated for 275 deg. F butterfly valve.
- H. NOTE: Valves 6" and smaller shall be equipped with the proper size 10 position Multi-lock hand lever. Valves 8" and larger shall be equipped with the proper size Extra Power Manual weatherproof gear operator.

I. Ball Valves:

For hot and cold domestic water service: Valves 2" and smaller shall be Crane No. 2190H bronze, screwed, 200# WOG, Gem ball valve with Buna-N rubber capsule. Watts B6000 or Apollo 70-100.

J. Strainers:

Strainers 1-1/2" and smaller shall be Crane No. 988-1/2, iron body, screwed Y-pattern, 200# WOG, sediment separators with a 20-mesh Monel screen.

K. All strainers shall be installed with fine mesh supplementary "construction screens" which shall remain in place while the system is flushed and chemically cleaned. The "construction strainer" basket shall be removed just prior to balancing the water systems.

L. Provide blow-down ball valve on all strainers same size as strainer tapping.

M. Gas Service:

1. Ball Valves:

Valves 2" and smaller shall be Crane No. 2330-TF, bronze, screwed, 400# WOG Accesso ball valve with teflon seats, and shall have Underwriters' approval for LP gases up to the pressure limit of 250 psi set by that agency.

2. Gate Valves:

Valves 3" and smaller shall be Crane No. 424, bronze, screwed, 400# WOG gate valve with Exelloy seats and shall have Underwriters' approval for LP gases up to the pressure limit of 250 psi set by that agency.

3. Globe Valves:

Valves 2" and smaller shall be Crane No. 130, bronze, screwed, 400# WOG globe valve with a No. 6 replaceable composition disc and shall have Underwriters' approval for LP gases up to the pressure limit of 250 psi set by that agency.

4. Check Valves:

Valves 2" and smaller shall be Crane No. 132, bronze, screwed, 400# WOG horizontal lift check valve with a No. 6 replaceable composition disc and shall have Underwriters' approval for LP gases up to 250 psi set by that agency.

5. Pressure Regulators:

Furnish and install approval type gas pressure regulators in gas piping ahead of each appliance and piece of equipment, to which is connected. Regulators located outside the building shall have weatherproof vent with bugproof screen. Regulators located inside of building shall be vented to the outside with weatherproof vent and bugproof screen.

2.4 NON-SLAMMING OR SPRING-LOADED CHECK VALVES

A. Types: Provide valves of the fully guided or cone-and-diaphragm types.

B. Bodies: Provide flanged or wafer type bodies constructed of cast iron ASTM A 126, Class B; cast steel ASTM A 216/A 216M, Class WCB; stainless steel, Type 304 or cast bronze ASTM B 61.

- C. Trim: Seats, discs and springs shall be constructed of 18-8 stainless steel or bronze complying with ASTM B 62. Seats may be of elastomers suitable for 250 degrees F. minimum continuous working temperature or not less than 50 degrees F. above the operating temperature of the system, whichever is higher.
- D. Mating Surfaces: Mating surfaces of closure faces shall be bronze or Type 316 or 17-4PH stainless steel or elastomer approved for the particular service and materials must be compatible to prevent electrolytic action.
- E. Pressure Loss: Pressure loss through the valves, measured in feet of water, shall not exceed 6/10 of the water velocity in feet per second.
- F. Bubble-Tight: Non-slamming and spring-loaded check valves shall provide bubble-tight shut-off when handling water up to 250 degrees F. and 125 pounds per square inch differential pressure. Design shall prevent rubbing of seat materials when opening and closing. Poppet valves shall have conical springs.

2.5 GENERAL DUTY VALVES & SPECIALTY COCKS

- A. Cocks:
 - 1. Balancing cocks 1-1/2" and smaller shall be Crane No. 80E, bronze, screwed, 200# WOG.
 - 2. Balancing cocks 2" and larger shall be Crane No. 325, all iron, flanged 125# WOG.
 - 3. Gas cocks 2" and smaller shall be Crane No. 270, flat head, bronze screwed.
 - 4. Gage cocks shall be Crane No. 744, 1/4", bronze, screwed.
 - 5. Petcocks shall be Crane No. 702, 1/4", bronze, screwed with lever handle.
 - 6. Trycocks shall be Crane No. 734, 3/8", bronze, screwed, 250# rated with stuffing box.
 - 7. Provide two complete sets of wrenches for all cocks and stops.

2.6 BACKFLOW PREVENTERS

- A. Backflow preventers shall comply with the requirements of the 2021 IPC and State Plumbing Code as to type, style, size, location, and arrangement for the actual installed duty.
- B. Where backflow preventers are installed which release water thru the valve to the atmosphere, these units shall be provided with drip pans which collect the free water. The drip pans shall be piped to the nearest drain.
- C. All backflow preventers shall be installed with all necessary isolation valves and test cocks.

2.7 AUTOMATIC VALVES AND WELLS

- A. The mechanical subcontractor shall install the automatic temperature control valves, temperature sensing wells, and flow switches, as directed by the automatic temperature control subcontractor.

2.8 UNIONS

- A. Ground joint unions shall be installed on pipe 2-1/2" and under where indicated on drawings. Whenever piping is connected to a major piece of apparatus, unions shall be provided as near as practical on each side of the apparatus.

2.9 ISOLATION FITTINGS

- A. Approved isolation fittings shall be installed at the junction of all copper and steel piping to prevent electrolytic action. **Fittings shall be NZR brass unions or fittings.**

2.10 THERMOMETERS

- A. General: Provide liquid-in-glass type thermometers or Vari-angle digital thermometers as manufactured by Weiss unless bimetal dial type is required due to space limitations or other conditions.
- B. Scale and Dial: Provide liquid-in-glass thermometers of the organic liquid type having a nominal scale length of not less than 7 inches. Provide bimetal dial thermometers with a nominal 5-inch dial size graduated through a minimum arc of 270 degrees. Provide a recessed dial so that graduated portion and pointer are in the same plane.
- C. Range: Temperature range shall be as shown on the drawings or as specified. Chilled water system 20 degrees F. to 120 degrees F. Hot water system 30 degrees F. to 240 degrees F. Condenser water system 30 degrees F. to 240 degrees F.
- D. Case: Provide liquid-in-glass type thermometer with an aluminum alloy or steel case. Provide bimetal dial thermometers with all exposed metal parts, including the case and stem made of 300 Series stainless steel, all welded construction.
- E. Accuracy and Calibration: Bimetal dial thermometers shall have zero adjustment for recalibration and shall have an accuracy of plus or minus one percent of span through the complete range. Liquid-in-glass thermometers used for indicating shall have an accuracy of plus or minus 0.5 degree unless otherwise required in other sections of the specifications, thermometers for commissioning tests shall have an accuracy of plus or minus 0.25-degree F.
- F. Thermometers measuring temperature for energy calculations shall have an accuracy of plus or minus 0.1-degree F.
- G. Thermometer Wells: Provide pipeline liquid-in-glass thermometers with a union connection, tapered bulb chamber and matching taper on well. Provide bimetal dial thermometers with a well to match bulb chamber. Provide wells for insulated pipe of the extension neck type suitable for insulation thickness. Provide wells fabricated of bronze, brass or 316 stainless steel suitable for the fluid or gas in the pipe.
- H. Stem: Provide stems with a minimum length of 2-1/2 inches immersion which shall be increased in length as necessary to reach the center lines of the pipes in which they are installed.
- I. Adjustment: Provide straight or angle pattern adjustable type thermometers as required to facilitate readings.
- J. Thermometers shall be Palmer, Terice, Marsh or Weiss. Install all thermometers so as to be easily readable from the floor.

2.11 PRESSURE GAUGES

- A. General: Provide pressure gauges which comply with ANSI B40.1.
- B. Dials: Provide dials not less than 4-1/2 inches in diameter, except that packaged equipment may be provided with manufacturer's standard gauges of equal accuracy.

- C. Ranges: Select operating ranges so that during normal service the gauge pointer will be at the approximate midpoint of the gauge scale.
- D. Refrigerant Gauges: Provide refrigerant pressure gauges with corresponding temperature scales for the particular refrigerant sensed.
- E. Accuracy: Pressure gauges used for commissioning of other equipment shall have a minimum accuracy of 3 percent of span.
- F. Gage Cocks: All gages shall be furnished with gage cocks and pressure snubbers.
- G. Gauges shall be Ashcroft, Trerice, or U.S. Gage.

2.12 PRESSURE & TEMPERATURE TEST PLUGS

- A. Plugs shall be brass body type with Neoprene, Nordel, or Vitron self-closing valve (to suit temperatures of fluid in pipe). Test plugs shall be Pete's Plug or approved substitute. Furnish six pressure and six temperature instruments to Owner to permit reading pressures and temperatures.

2.13 V-BELT DRIVES

- A. Capacity of V-belt drives at rated RPM shall be not less than 150 percent of motor nameplate horsepower rating.
- B. V-belt drive combinations shall be limited to A, B, C, and fractional horsepower belts. 3V, 5V, and 8V belts and sheaves shall not be used.
- C. Drives requiring single belt application shall be of the adjustable pitch type. Multiple belt drives shall be of the non-adjustable type. All fixed pitch sheaves, including single groove fan sheaves, shall be of the bused type. Fixed bore sheaves will not be acceptable for non-adjustable pitch sheaves.

2.14 HEATING CABLE

- A. Furnish and install complete electrical heating cable on all pipe and fittings which may be exposed to freezing. Heat cable shall be of the self-regulating low temperature type with a heat output of 8 watts/ft. (27 BTUH/ft), and a weather-proof PVC sheath. The heating cable shall automatically adjust heat output to correspond with the heat loss rate. Cable shall be UL and FM approved for use in rainwater downspout ice melting applications, and for freeze Protection on exterior piping systems.
- B. Cable system shall be furnished with power termination, end seal kits, splice and tee fittings, and all accessories required for a complete installation.
- C. Thermon, Raychem, or prior approved equal.

2.15 MAGNETIC STARTERS

- A. Contractor furnishing "packaged equipment" with 1/2 HP and larger motors shall furnish factory-mounted magnetic starters. Magnetic starters shall provide both overload and undervoltage protection and shall have integral hand-off-auto switch, auxiliary contacts, and pilot. All motors installed under this contract shall have a disconnect switch in the immediate vicinity of the motor. Starters on three phase motors shall protect all three legs of the circuit. Starters to be Cutler-Hammer, Square "D", or Westinghouse.

- B. Starters for all motors on other than "packaged equipment" which are furnished under the mechanical section of the work will be installed by the electrical contractor.
- C. Starters shall be two-speed type or explosion-proof type where required.
- D. Provide a heater index bound in the O & M manuals for all starters furnished on the project.

2.16 MISCELLANEOUS ITEMS

- A. Motors:
 - 1. Motors shall be furnished and installed under the applicable Mechanical Sections of the Specifications.
- B. Each motor shall be provided with a nameplate for the electrical characteristics shown on the Drawings or as otherwise noted.
- C. Motors shall be constructed and rated to deliver full nameplate capacity at the project altitude.
- D. Horsepower shall be at least equal to that shown on the drawings. Where equipment is submitted and approved for the installation which requires larger motor sizes than shown, the wire and starter sizes shall be increased and means provided for operation and control suitable for the larger motors with no increase in cost to the Owner.
- E. Unless otherwise specified, or required for controller sequencing, all motors over 5 HP shall be high efficiency type, and all fractional HP single phase motors 1/2 HP & under shall be permanent split capacitor (PSC) type.
- F. Premium efficiency motors shall be based on CEE premium efficiency criteria for OPD motors at 1800 RPM.

HORSEPOWER	NEMA PREMIUM EFFICIENCY
5	89.5%
7.5	91.0%
10	91.7%
15	93.0%
20	93.0%
25	93.6%
30	94.1%
40	94.1%
50	94.5%

- G. Motors for V-belt drives shall be provided with cast iron or steel base, with slide rail and adjustable screw device and shall be isolated by rubber-in-shear devices.
- H. Motors shall have sufficient capacity to start and operate the machine it drives without exceeding the motor nameplate rating at the speed specified or at any speed and load which may be obtained by the drive actually furnished.
- I. Motors provided with automatic control shall be capable of making as frequent starts as the control device may demand. Motors not provided with automatic control shall be capable of making not less than 4 starts per hour.

- J. All belt-connected motors, regardless of size, shall be equipped with shafts and bearings that will withstand both the normal belt pull of the drive furnished and the momentary or continuous overloads due to acceleration of incorrect belt tension.
- K. Motors shall be air cooled and shall be guaranteed to operate continuously at 115% of full load with temperature rise in any part not to exceed 40 degrees C above the ambient air temperature.
- L. Motors shall be open drip-proof or totally enclosed fan cooled type as required, and shall be commercially dynamically balanced and tested at the factory before shipment.
- M. Motors shall be selected for quiet operation. Sound power levels shall be within NEMA MGI-12.49.
- N. Motors shall comply with requirements of ANSI C 50, NEMA MG-1, and all NEMA standards.
- O. Motors controlled by variable frequency drives shall have characteristics which are fully compatible with the drives to which they are connected. Provide written confirmation of coordination with VFD supplier.
- P. Approved Manufacturers: Allis-Chalmers, Century, Gould, Lincoln, Reliance, Westinghouse, U.S.

2.17 SEISMIC RESTRAINTS

- A. All Division 21, 22 & 23 equipment, piping, and ductwork shall be anchored and seismically restrained as required by the IBC for Seismic Zone D, NFPA 90A (current edition), UL Standard 181, Tri-services Manual Fagel Et Al 1973, and the SMACNA Guidelines for seismic restraints of mechanical systems.
- B. The Division 21, 22 & 23 contractor shall be responsible for supplying and installing equipment, vibration isolators, flexible connections, rigid steel frames, anchors, inserts, hangers and attachments, supports, seismic snubbers and bracing to comply with Seismic Zone D of the International Building Code.
- C. All supports, hangers, bases, anchorage and bracing for all isolated equipment shall be designed by a professional engineer employed by the restraint manufacturer, qualified with seismic experience in bracing for mechanical equipment.
- D. Shop drawings submitted for earthquake bracing and anchors shall bear the Engineer's signed professional seal.
- E. The above qualified seismic engineer shall determine specific requirements on equipment anchorage and restraints, locations and sizes based on shop drawings for the mechanical equipment which have been submitted, reviewed and accepted by the Owner's representative for this project.
- F. The Division 21, 22 & 23 contractor shall require all equipment suppliers to furnish equipment that meets the seismic code, with bases designed to receive seismic bracing and/or anchorage. All isolated mechanical equipment bracing to be used in the project shall be designed for the equipment shop drawings and certified correct by the equipment manufacturer for Seismic Zone D with direct anchorage capability.
- G. Submit shop drawings, calculations, and printed data for the following items under provisions of the General Conditions of the Contract:

1. Complete engineering calculations and shop drawings for all vibration and seismic requirements for all equipment to be isolated and restrained.
 2. The professional seal of the engineer who is responsible for the design of the Vibration and Seismic restraint System for isolated equipment.
 3. Details for all the isolators and seismic bracing with snubbers proposed for items in this specification and on the drawings.
 4. Details for steel frames, concrete inertia bases, and anchors to be used in conjunction with the isolation of the items in this specification and drawings.
 5. Clearly outlined procedures for installing and adjusting the isolators, seismic bracing anchors and snubbers.
 6. The location of all restraints of pipes and ducts with the locations shown on a floor plan noting the size and type of anchorage and restraint to be used.
- H. Snubbers:
1. Snubbers shall be double acting and consist of interlocking steel members restrained by replaceable shock absorbent elastomeric materials a minimum of 3/4 inch thick.
 2. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch nor more than 1/4 inch.
 3. A one "g" minimum vertical and lateral level shall be used in the design of all snubbers restraining isolated equipment.
- I. Design and Installation:
- J. General: All mechanical equipment, piping and ductwork shall be braced, anchored, snubbed or supported to withstand seismic disturbances and remain operational. Provide all engineering, labor, materials and equipment for protection against seismic disturbances as specified herein.
- K. All equipment not anchored directly to the floors shall be restrained by cables as designed and furnished by the Restraint Manufacturer.
- L. Isolated Equipment: All vibration isolated equipment shall be mounted on rigid steel frames or concrete bases as described in the vibration control specifications unless the equipment manufacturer certified direct attachment capability. Each spring mounted base shall have a minimum of four all-directional seismic snubbers that are double acting and located as close to the vibration isolators as possible to facilitate attachment both to the base and the structure. Snubbers shall be installed with factory set clearances.
- M. Piping: All isolated and non-isolated piping 2-1/2" I.D. and larger shall be protected in all planes by restraints to accommodate thermal movement as well as restrain seismic motion. Where necessary the piping restraints shall be resiliently attached to the piping with vibration dampening inserts to prevent the transmission of vibration to the building structure. Locations shall be as scheduled and shall include but not be limited to:
1. At all drops to equipment and at flexible connections.
 2. At all 45 deg. or greater changes in direction of pipe.
 3. At horizontal runs of pipe, not to exceed 30 ft. O.C. spacing.
 4. Piping shall be restrained by a cable restraining system using a minimum of two cables at all restraint points.
- N. Piping in mechanical rooms shall have additional restraints as scheduled.
- O. Non-Isolated Equipment: The restraint systems for all non-isolated equipment are to be installed to resist stresses produced by lateral forces according to Sec. 2312 of the Uniform Building Code with an Occupancy Importance Factor of 1.5, a Seismic Zone Factor of $Z = 0.75$ for Zone D and a

Horizontal Force Factor for Elements of Structures and Nonstructural Components of $C_p = 0.3$. In addition, the vertical forces restraint requirement shall be half the value of the horizontal forces. All equipment not anchored directly to floors shall be restrained by cables as designed and furnished by the Restraint Manufacturer.

P. Acceptable Manufacturers and Suppliers for Non-Isolated Systems:

1. Mason Industries, Inc.
2. Korfund
3. Amber/Booth Company
4. Vibration Mountings and Control Company

Q. Manufacture and design of restraints and anchors for internally isolated equipment shall be the responsibility of the manufacturer of the vibration isolators furnished with the equipment.

R. Piping, ductwork, and equipment without moving parts shall be restrained as shown and noted on the drawings. Locations shown are approximate and shall be coordinated with other trades and with the structural engineer at the job site.

S. Field Services:

The seismic restraint manufacturer's engineer shall inspect the final installation and shall certify that all seismic restraints have been installed per manufacturer's instructions and applicable codes and standards.

2.18 GREASING AND OILING

A. Prior to placing the equipment in operation, the bearings on all motors, fans, pumps, etc., shall be properly lubricated with a lubricant suitable for the service.

B. Lubrication instruction tags are to be left on "all" bearings and equipment for the Owner's future use. Only lubricants recommended by the equipment manufacturers shall be used.

C. It shall be incumbent on the contractor to operate the building equipment used for temporary heat, etc., in a prudent manner to ensure that when the building is turned over to the Owner all equipment is in a "first-class" condition.

D. Equipment shall not be operated unless:

1. All safety devices are installed and functioning properly.
2. Filters are in place on fan systems. Filters to be new and clean.
3. Equipment is properly greased and oiled.
4. Belts and drives are properly aligned and adjusted.

E. The contractor shall maintain a current "equipment maintenance" chart in the construction shack at all times. This chart shall be posted in a conspicuous place and shall include all items of maintenance necessary for proper operation of the equipment.

F. Equipment used for temporary heat and cooling shall, if requested by the Contracting officer, have tube bundles pulled by contractor for Owner inspection prior to acceptance.

2.19 VALVE TAGGING

- A. All valves shall be designated by distinguishing numbers and letters on required charts and diagrams. The contractor shall furnish and install approved brass tags for all designated items, which numbers and letters on the tags corresponding to those on the charts and diagrams.
- B. Brass tags shall be not less than 1-1/2" diameter with depressed black filled numbers not less than 1/2" high and black filled letters not less than 1/4" high. Tags shall be securely fastened to valves with approved brass "S" hooks, or brass jack chain, in a manner to permit easy reading. Zips ties are not acceptable. Do not attach to valve wheel. Brass tags shall be as manufactured by Seton Name Plate Company, New Haven, Connecticut, or approved equal.
- C. Each valve shall have an identifying number identifying the unit. Standard identifications may be used for identifying type of service or fluid in pipe. The contractor shall submit his system of identification to the Owner's representative for approval prior to ordering. Any work done without this approval is done at the contractor's risk.
- D. Charts of all valves shall be furnished to the Owner's representative by the contractor.
- E. A chart to be mounted in a frame with clear glass front and secured on the wall in the main Mechanical Equipment Room.
- F. Second chart shall be prepared for use outside of the equipment room, and to be provided with an approved heavy transparent plastic closure for permanent protection. Two (2) holes to be punched at top of plastic closure to allow for affixing approximately an 8" length of nickel-plated bead chain. Each hole to be reinforced by means of a small brass or nickel grommet. Plastic closure shall be as manufactured by Seton Name Plate Company, New Haven, Conn., or approved equal.
- G. Identify all valves. A sample identification shall be as follows:

VALVE IDENTIFICATION CHART

NUMBER	DESCRIPTION	LOCATION	NORMAL POSITION
1.	Cold Water Supply to Water Heater	Mech. Room #121	Open
2.	Cold Water Supply to Hose	Room #13	Open
3.	Cold Water Supply to Equip. in Room #12	Room #18	Open
4.	Hot Water Supply to Toilet Room #212	Chase #210	Open
5.	Air Vents - Cooling Coil #12 (2 required)	Fan Room 3122	Closed

- H. The above room numbers shall be the room numbers used. Coordinate with architectural signage plan
- I. Mechanical Equipment & Ductwork:

All mechanical equipment, including meters, fans, pumps, and other devices shall be identified with signs made of laminated plastic 1/8" or larger engraved letters. Signs shall be securely attached by rustproof screws or some other permanent means (no adhesives).
- J. Information on sign shall include name of equipment, rating, maintenance instructions, and any other important data not included on factory attached nameplate.

- K. Signs shall be attached to equipment so they can be easily read.
- L. Identify all ducts exposed in mechanical equipment rooms and in ducts and pipe chases. Sample duct identification shall be as follows:
 - 1. "Cold Duct - High Pressure - To Second Floor System"
 - 2. "Exhaust Duct - Toilet Room - To EF-3"
 - 3. "Ventilation Air Duct - To Utility Room #228"
- M. Ducts shall be labeled at all wall penetrations and at connections to equipment.

2.20 PAINTING

- A. Mechanical Contractor: All equipment which is to be furnished in factory prefinished conditions by the mechanical contractor shall be left without mark, scratch, or impairment to finish upon completion of job. Any necessary refinishing to match original shall be done. Do not paint over nameplates, serial numbers, or other identifying marks.
- B. Mechanical Contractor: Spot painting for application of pipe and equipment identification markers. All piping exposed to weather.
- C. Painting Contractor: All insulated piping and all piping in equipment rooms of finished areas shall be painted, as required by the painting specifications. Colors to be selected by owner.
- D. Coding, Pipe Identification & Painting:
- E. All pipes are to be labeled and color coded with contents clearly identified and arrows indicating direction of flow. Pipes shall be identified at the following locations:
 - 1. Adjacent to each valve.
 - 2. At every point of entry and exit where piping passes thru wall or floor.
 - 3. Every 50 feet on long continuous lines.
 - 4. On each riser and junction.
 - 5. Adjacent to all special fittings or devices (regulating valves, etc.)
 - 6. Connection to equipment.
- F. Apply markers to they can be read from floor.
- G. Labels and markers shall be of the self-sticking, all temperature permanent type as manufactured by W. H. Brady Co., 727 West Glendale Avenue, Milwaukee, Wisconsin, or Seton Name Plate Corp., 592 Boulevard, New Haven, Connecticut.
- H. Pipe color coding shall be uniform throughout.
- I. Background colors shall be as follows:

Yellow:	Dangerous Materials (natural gas condensate, etc.)
Bright Blue:	Protective Materials (filtered water)
Green:	Safe Materials (chilled water, cold water, instrument air, sanitary sewer, etc.)
- J. Letters of identification legend shall be 2" high for pipes 3" and larger, and 1" high for pipes 2-1/2" and under.
- K. Markers shall be installed in strict accordance with the manufacturer's instructions.

- L. On chalky and loose insulation, soft, porous, fiber-filled or fiberglass coverings, a spiral wrap of pipe banding tape shall be made around the circumference of the pipe. Sufficient spiral wraps shall be made to accommodate the horizontal dimension of the pipe marker.
- M. On bare pipes, painted pipes, and pipes insulated with a firm covering, pipe banding tape matching the background color of the marker shall be used for 360 deg. color coding. After applying pipe markers, wrap pipe banding tape around pipe at each end of marker. Tape should cover 1/4" to 1/2" of each end of marker and should overlap approximately 1/2" to 1" on itself. Be sure pipe surface is dry and free of dirt or grease before applying markers or banding tape.
- N. Stenciling may be used in lieu of the above labels and markers if finished application gives the same overall appearance, that is that stenciling is applied over a background color. If stenciling is used, letter heights, background colors, banding, and arrow shall be as specified above. Submit sample to Owner's representative before proceeding with work.
- O. Plastic Marking Tape:
- P. Provide and install a continuous plastic tape over the top of all underground utilities. Tape shall be placed 1/2 way between finished grade and top of utility line.
- Q. Plastic marking tape for underground utilities shall be acid and alkali-resistant Polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in Table 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1 – TAPE COLOR

Yellow	Gas, Oil, Dangerous Materials
Blue	Water Systems
Green	Sewer Systems

- R. Ceiling Markers:

Use stick on ceiling markers on all accessible ceiling grid to indicate location of VAV boxes, valves, and dampers.

- 1. Color code as follows:

Yellow	HVAC
Green	Plumbing
Blue	Air
White	Duct valves
Orange	Electrical Devices
Red	Fire

PART 3 – EXECUTION

3.1 COORDINATION

- A. All equipment and piping shall be arranged to allow for easy maintenance and access to service valves.
- B. Provide valves and unions or flanges at all pieces of equipment to allow maintenance.
- C. Install all automatic valves, sensor well, flow switches, etc., as directed by the control contractor.

3.2 TESTING

- A. All piping shall be tested in accordance with Section 230501 prior to applying insulation or concealing in partitions, wall, etc.

3.3 ACCESS

- A. All valves and equipment shall be located to allow easy access for inspection, service and maintenance, test and balance, and operation. If valves are installed in inaccessible locations, it shall be this contractor's responsibility to furnish and install access doors of a type approved by the owner's representative.
- B. Locate piping, valves, etc., to allow easy access to and maintenance of equipment. Do not block walkways, filter access, maintenance access, or tube-pull space in equipment rooms.

3.4 LOCATIONS & ARRANGEMENTS

- A. All pressure gages shall be so installed as to be easily readable from an eye level 5' -6" above the floor.
- B. Test plugs on flow measuring stations shall be unobstructed and shall be arranged in the piping per manufacturer's recommendations.
- C. All equipment and accessories shall be installed to facilitate proper service and maintenance in compliance with the manufacturer's recommendations.

3.5 WIRING BY THE ELECTRICAL CONTRACTOR

- A. It is the intent of these specifications that all line voltage electrical power wiring and power connections to equipment be furnished and installed by the electrical contractor, unless otherwise specified or shown on the drawings.
- B. The mechanical contractor shall coordinate actual job-site power requirements with the electrical contractor prior to installation of power wiring and electrical equipment.
- C. The electrical contractor shall provide necessary wiring to electric heat tape as required and shall coordinate with the mechanical contractor the location and capacity of required circuits.
- D. When mechanical system components are furnished with remote mounted control panels, alarm bells, alternators, etc. the electrical contractor shall run all required line voltage power wiring as directed by the mechanical contractor. It shall be the mechanical contractor's responsibility to coordinate the work and provide the necessary wiring diagrams.

- E. When exhaust fans are provided which are not controlled by the ATC contractor, they shall be wired to local line voltage wall switches. The wall switch locations shall be coordinated with the owner's representative.
- F. Line and low voltage control wiring will be furnished and installed by the ATC contractor in accordance with NEC and Division 26. Minimum 3/4" conduit.

3.6 STORAGE AND INSTALLATION OF MOTORS

- A. Handle motors carefully to prevent damage, denting and scoring. Do not install damaged motors or components; replace them with new.
- B. Store motors and components in a clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage.
- C. Install motors where indicated on the drawings and in accordance with manufacturer's drawings and in accordance with manufacturer's published installation instructions.
- D. Install each direct-connected motor such that it is securely mounted in accurate alignment. The drive must be free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures. Provide each belt-connected motor with a securely mounted adjustable base to permit installation and adjustment of belts.

3.7 INSTALLATION OF ABOVE GROUND PIPING

- A. Provide piping systems of sizes indicated on the drawings. Systems shall be installed complete.
- B. Install piping systems in conformance with ANSI B31.
- C. Install piping to allow for expansion and contraction of the piping systems. Provide offsets and swing joint connections at coils, pumps and other equipment to eliminate undue strain to the equipment connections.
 - 1. Connect flanges and tack weld piping systems in place before full circumferential welds are made.
 - 2. Springing of piping at equipment connections will not be permitted.
 - 3. The use of "cold-spring" is not permitted.
- D. Branch connections to up feed systems shall be made at the top or at a 45-degree angle above the centerline. Branch connections for down feed systems shall be made at the bottom or at a 45-degree angle below the centerline.
- E. Install water piping with a pitch or slope of not less than 1-inch in 40 feet.
 - 1. Provide 3/4-inch diameter plugged drain valves at each low point in mechanical rooms.
- F. High Points: At each high point of the piping system provide a 3/8-inch diameter plugged globe valve.
 - 1. Where high points are located in an inaccessible position, provide a 3/8-inch diameter bleed line from the high point of the piping system and extend to an approved location, with access. Anchor bleed piping and provide 3/8-inch diameter globe valve.

- G. Support, anchor, and guide piping systems to preserve piping flexibility and the isolation effects of sound and vibration isolation hangers.
- H. Conform to the welding and welder qualification requirements paragraph of this Section.
 - 1. Perform welding in conformance with ANSI B31.1.
 - 2. Perform welding in ambient temperatures above 0 degrees F.
 - 3. Ream and clean ends of piping.
 - 4. Support piping align and tack weld making allowance for pipe pitch and insulation. Temporarily block piping at hangers.
 - 5. Use welding pipe clamps on piping 4-inch diameter and larger and verify alignment before welding.
- I. All installed pipelines shall be straight, free from dents, scars and burrs, with ends reamed smooth and shall remain straight against strains tending to cause distortion during system operation. The Contractor shall make proper allowance for pipeline expansion and contraction so that no unsightly distortion, noise, damage or improper operation will occur.
- J. Piping shall be run in a neat and efficient manner and shall be neatly organized. Piping shall be run parallel or at right angles to the building walls or construction. The Contractor shall study the general, electrical, and other drawings to eliminate conflict of piping with structure, sheet metal, lighting, or other services. Unless specified otherwise, no piping shall be exposed in a finished room, all changes in direction shall be made with fittings.
- K. All piping shall be clean and free from acids and loose dirt when installed.
- L. Temporary pipe plugs of rags, wool, cottons, waste or similar materials shall not be used.
- M. All piping shall be so arranged to not interfere with removal of other equipment or devices and shall not block access openings, etc.
- N. Piping shall be arranged to facilitate equipment maintenance.
- O. Flanges or unions shall be provided in the piping at connections to all items of equipment.
- P. All piping shall be so installed to insure noiseless circulation.
- Q. All valves and specialties shall be so placed to permit easy operation and access, and all valves shall be regulated and adjusted at the completion of the work.

3.8 VALVE INSTALLATION

- A. After piping system has been tested and put into service, but before final testing, adjusting and balance, inspect each valve for possible leak. Open and close each valve to verify proper operation.

3.9 INSTALLATION OF UNDERGROUND PIPING

- A. Coordinate the routing and location of all underground piping with building footings. See structural drawings.
- B. Outside pipe placed underground shall be buried deep enough to protect against freezing.
- C. Depth of bury of services shall be:

	Minimum	Preferred
Sewer	48"	48"
Rainwater	48"	48"
Water	60"	60"
Gas	36"	36"
Fire	60"	60"

- D. Services shall be buried at the "preferred" depth unless site conditions require the "minimum" depth as listed above.
- E. Handling: Pipe and accessories shall be handled so as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the owner. Rubber gaskets that are not to be installed immediately shall be stored in a cool dark place.
- F. Coated and wrapped steel pipe shall be handled in conformance with AWWA Standard C203.
- G. Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contractor Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutters shall be used when practicable.
- H. Copper tubing shall be cut square and all burrs shall be removed.
- I. Locating: Where the location of the water pipe is not clearly defined by dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall, in all cases, cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.
- J. Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.
- K. Copper tubing shall not be installed in the same trench with ferrous piping materials.
- L. Nonferrous metallic pipe: Where nonferrous metallic pipe, e.g., copper tubing, crosses any ferrous piping material, a minimum vertical separation of 12 inches must be maintained between pipes.
- M. Plastic pipe shall be insulated against heat from steam lines, water lines, or other heat sources.

- N. Placing and Laying: Pipe and accessories shall be carefully lowered into the trench. Under no circumstances shall any of the materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon a compacted sand bed, with recessed excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until jointing is completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as required.
- O. Where prescribed by the manufacturer of the pipe, gaskets shall be placed in the groove on the end of the pipe before the pipe is placed in the trench. After the pipe has been forced together, the position of the rubber gasket shall be checked with a feeler gage in accordance with the pipe manufacturer's recommendations.
- P. Pipe shall be protected during handling against impact shocks and free fall and the pipe interior shall be free of extraneous material.
- Q. Laying of gravity drain shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the pipe has a uniform invert. As the work progresses, the interior of the pipe shall be cleared of all superfluous materials.
- R. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints in gravity drain lines shall then be placed, fitted, joined, and adjusted so as to obtain the degree of water tightness required.

3.10 EXCAVATION

- A. Excavation of every description and of whatever substances encountered shall be performed to the lines and grades indicated. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected from contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material, if directed, shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to the owner. Excavated material not required or not satisfactory for backfill shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Sheet piling and shoring for the work and for the safety of personnel shall be in compliance with applicable safety standards.

- B. Trench Excavation: The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below and above the top of the pipe shall be sloped, or made vertical, as recommended in the manufacturer's installation manual. The trench width below the top of the pipe shall not exceed that recommended in the installation manual. Where no manufacturer's installation manuals are available, trench walls below the top of the pipe shall be vertical, and trench walls above the top of the pipe shall be sloped as required to properly complete the work. Trench width below the top of the pipe shall not exceed 24 inches plus pipe outside diameter (O.D.). Where recommended trench widths are exceeded, redesign shall be performed by the Contractor using stronger pipe or special installation procedures. The cost of this redesign and the increased cost of the pipe or installation procedures shall be borne by the Contractor without additional cost to the Owner.
- C. Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.
- D. Removal of Unyielding Material: Where over depth is not indicated and unyielding material is encountered in the bottom of the trench, such material shall be removed 4 inches below the required grade and replaced with suitable materials.
- E. Removal of Unstable Material: Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material. When removal of unstable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.
- F. Excavation for Appurtenances: Excavation for manholes, catch basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structural footings and foundations as shown. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.11 BACKFILLING

- A. Backfill material shall consist of satisfactory material. Backfill shall be placed in layers not exceeding 4 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density unless otherwise specified.
- B. Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 2 feet above the top of the pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test.
- C. Replacement of Material: Material removed from the bottom of the trench shall be replaced with 6" sand base prior to the installation of piping. Piping shall be encased in sand with a 6" top layer over the top of the piping.

- D. Initial backfill material shall be placed in layers of a maximum of 4 inches loose thickness and compacted with approved tampers to the density of the adjacent soil and to a height of at least 1 foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of pipe for full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Backfill material in this portion of the trench shall consist of satisfactory material at a moisture content that will facilitate compaction free from stones of such size as recommended by the pipe manufacturer, or larger than 2 inches in any dimension, whichever is smaller, except that where the pipe is coated or wrapped for protection against corrosion, the backfill material shall be free of stones larger than 1 inch in any dimension, or as recommended by the pipe manufacturer, whichever is smaller.
- E. The remainder of the trench, except for special materials for roadways, shall be backfilled with satisfactory material. Backfill material shall be deposited and compacted as follows:
- F. Degree of Compaction: Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, Method B or D.

3.12 INSTALLATION OF VALVES

- A. Gas Cocks: Provide and install gas cocks at connection to gas train for each gas-fired equipment item; and on risers and branches where indicated on the drawings. Locate gas cocks where easily accessible and where they will be protected from possible injury.
- B. Pressure Regulating Valves: Install pressure regulating valves in accordance with local utility company's requirements and manufacturer's installation instructions. Install gas shutoff valve upstream of each pressure regulating valve. Each pressure regulating valve shall have an independent vent piped to the outside of the building. Vents shall be terminated with an approved bug screen fitting.

3.13 INSTALLATION OF NATURAL GAS PIPING

- A. General: Install natural gas piping as shown on the drawings in accordance with NFPA 54 and as follows.
- B. Caulk spaces watertight between pipes and sleeves passing through exterior walls, slabs on grade and over crawl spaces, and waterproofed floors. Pack and seal spaces between pipes and sleeves passing through floors, walls, and ceilings of machine spaces, such as mechanical equipment, refrigeration, boiler, pump, fan, and machinery rooms at both ends of sleeve to provide an airtight acoustical barrier.
- C. Unless otherwise indicated, gas piping shall be run exposed. Where concealed piping is indicated, it shall be installed inside of a welded steel casing which is vented on both ends and, in a location, to permit access to the piping casing with a minimum amount of damage to the building.
- D. The gas supply pipe shall be of the size indicated on the drawings.
- E. A stop cock or tee handled gate valve, with cast-iron extension box and cover, shall be installed in the gas supply pipe near the curb. A brass gas cock shall be installed in the gas supply pipe just inside the building wall. If the gas supply pipe is larger than 2-inch size, a bronze mounted iron body gate valve may be provided in lieu of the brass cock.
- F. Joints shall be welded from the seismic shut-off valves to the gas train connections at the boilers. Other non-welded joints shall be made with graphite and oil or an approved graphite compound applied to the male thread only. After cutting, and before threading, pipe shall be reamed, and all

burrs shall be removed. Threads shall be accurately cut, and not more than three threads shall remain exposed outside each fitting after the joint has been made up. Each length of pipe shall be hammered, and all scale shall be blown out before assembling. Threaded joints shall not be caulked to prevent or stop leaks.

- G. An approved type gas cock shall be installed in the branch connection to each riser and near each appliance. Plugged or capped outlets for future extensions or connections shall be provided where noted on drawings.
- H. Piping shall be graded not less than 1-inch in 40 feet of length to prevent trapping. The gas supply pipe from the main in the street to the meter shall grade up toward the meter. Horizontal lines from the meter to the risers shall grade down toward the risers and branches from risers to appliances shall grade up toward the risers and branches from risers to appliances shall grade up toward the appliances.
- I. A full-size tee fitting and a 6-inch long capped drip pocket shall be installed at the bottom of each riser or drop and at each low point in a horizontal gas line.
- J. Uncovered, exposed pipes shall be provided with plates at the point where they pass through floors, finished walls, and finished ceilings. Where necessary to cover beads of fittings, special deep escutcheons shall be provided in lieu of plates. Plates shall be not less than 0.018-inch thick. Wall and ceiling plates shall be secured with round headset screws, not with spring clips. Unless otherwise specified, plates shall be of the one-piece types. Wall and ceiling plates may be flat, hinged pattern.
- K. Unions shall be installed in the gas piping between the gas burning appliance and the gas shut-off valve serving the appliance.

3.14 INSTALLATION OF THERMOMETERS AND THERMOMETER WELLS

- A. General: Install thermometers and thermometer wells at locations shown on the drawings and where specified. Install thermometers so that they can be read by a person standing on the floor and with normal illumination.
- B. Locations: Install thermometers and thermometer wells at the following locations, and elsewhere as indicated.
 - 1. Thermometer Wells: Drill and tap pipes 5-inch and larger for installation of wells. Provide tees or reinforced welding fittings on pipes smaller than 5-inch for installation of wells. Provide oversize tees or enlarge pipe smaller than 3-inch at points where wells are installed to avoid restriction of flow.

3.15 INSTALLATION OF PRESSURE GAUGES

- A. General: Install pressure gauges at locations shown on the drawing and where specified.
- B. Locations: Install pressure gauges in the following locations, and elsewhere as indicated.
 - 1. At the discharge of each pressure reducing valve.
 - 2. At the water service outlet.
- C. Pressure Gauge Cocks: Provide stem mounted pressure gauges with T-handle cocks and pressure snubbers.

END OF SECTION

SECTION 23 3000 - AIR DISTRIBUTION

PART 1 – GENERAL

1.1 SCOPE

- A. Work shall include the air distribution, ventilation, and exhaust duct systems, and all materials, equipment, and labor required to complete the systems shown on plans and specified herein.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Construct all ducts, plenums, etc., of the gauges specified in the latest editions of the applicable SMACNA manuals, unless otherwise shown. Sheets shall be free from blisters, slivers, pits, and imperfectly galvanized spots.
- B. Duct construction and installation details shall comply with the latest edition of the SMACNA Duct Construction Standards.
- C. All supply air ducts shall be designed to meet the requirements for +2-inch pressurized ducts. All exhaust ducts shall be -2-inch suction ducts.

2.2 +4" PRESSURE CLASS DUCTWORK

- A. All ductwork on the discharge side of Air Conditioning units to the terminal boxes shall be +4" pressure class duct. It is the essence of the duct system to have a minimum pressure loss. Therefore, ducts shall be run in a straight line and shall be run so that the lowest beam or obstruction shall generally determine the centerline of the straight run. Eccentric reducing transition shall be avoided but may be used where space is a determining factor. Bends and elbows other than those shown on the drawings shall have the approval of the Owner's representative before installation. No pipes, conduits, or any other obstructions shall be run through +4" P.C. ductwork.

2.3 ACCESS DOORS AND PANELS

- A. Location: Provide access doors in casings, plenums, and ducts where shown on the drawings and where specified for ready access to operating parts including fire dampers, smoke dampers, valves, and concealed coils.
- B. Pressure Clarification: Construct and install access doors in accordance with SMACNA Standards to suit the static pressure classifications and the locations where installed.
- C. Access Doors in Ducts: Provide and size doors as follows:
 - 1. Minimum 24-inch by 24-inch clear opening.
 - 2. When field conditions require an access opening smaller than 16-inch by 12-inch, provide a 24-inch long removable section of casing or duct, secured with quick acting locking devices, 6 inches on centers, to permit ready access without dismantling other equipment.

D. Door Requirements: Provide doors in casings and duct as follows:

1. Arrange doors so that system air pressure will assist closure and prevent opening when the system is in operation.
2. Coordinate doors and equipment to provide unrestricted passage through clear door opening, without removal of any equipment.
3. Where pressure regulating dampers are installed in ducts or plenums, provide access doors with a clear wire glass observation port, 6-inch by 6-inch minimum size. Anchor port with structural metal frame, resilient gaskets and stainless steel bolts.
4. Hinges for doors in zinc coated or aluminum construction shall be steel or iron, zinc coated with brass pins.
5. Hinges for doors in copper, copper nickel alloy construction shall be all brass.

2.4 CLOSURE COLLARS

- A. A duct ending at a wall or partition shall have the edge turned back to form a closure collar and flanged tight to the wall or partition so that no sharp or ragged edge appears.

2.5 FLASHING

- A. Where ducts pierce roof construction, the flashing shall be provided as part of Division 7.
- B. The equipment bases and duct opening bases on the roof shall be constructed by this Contractor as shown on the drawings. The base shall be constructed to fit the equipment approved for construction. This Contractor shall construct and install a weatherproof inverted pan over the wood bases to act as a counterflashing and weatherproof hood for the base. All openings through the pan for equipment mounting shall be sealed weathertight with lead washers.

2.6 TEST HOLES IN DUCTWORK

- A. Test holes for testing air quantities in ducts shall be installed at locations to be specified by the Balancing Contractor. Rubber stoppers shall be provided for closing the test holes. Where these holes are installed in insulated ductwork, a removable plug of approved insulation material shall be provided. An instrument port shall be provided in the following locations for each fan system.
1. Return air shaft and/or duct upstream of sound traps:
 2. Return air fan plenum
 3. Main return air duct upstream of fresh air dampers
 4. Mixed air plenum
 5. Supply fan plenum
- B. Additional ports are to be installed in locations determined by the Owner's representative.
- C. Instrument ports shall be die cast with screwed cover for the insulation thickness specified. Ports shall be located outside of the plenum with 20-gauge sheet metal sleeve of the same size as the port opening, passing through insulation where ducts have interior insulation.

2.7 CLEANOUT OPENINGS

- A. Duct systems shall have cleanout openings equipped with tight fitting sheet metal doors. Doors shall be tightly latched without the use of tools.

2.8 FIRE-RESISTIVE ACCESS OPENING

- A. When cleanout openings are located in ducts within a fire-resistive shaft or enclosure, access openings shall be provided in the shaft or enclosure at each cleanout point.
- B. These access openings shall be equipped with tight-fitting sliding or hinged doors which are equal in fire-resistive protection to that of the shaft or enclosure.

2.9 CLEARANCES

- A. Duct systems shall have a clearance from combustible construction of not less than 18 inches. This clearance may be reduced to not less than three inches, provided the combustible material is protected with materials approved for one-hour fire-resistive construction on the duct side.

2.10 EXHAUST OUTLETS

- A. Exhaust outlets shall extend thru the roof, unless otherwise noted. Such extension shall be at least two feet above the roof surface, at least 10 feet from any adjacent building, property line, or air intake opening into any building, and shall be located at least 10 feet above the adjoining grade level.

2.11 BRANCH TAKEOFFS

- A. Branch takeoffs shall be as shown on the drawings, and shall be fitted with adjustable lock balancing dampers, complete with locking quadrants. Where dampers are not accessible for adjustment from above, concealed ceiling regulators with adjustable chrome-plated covers shall be provided.

2.12 WALL PENETRATIONS

- A. All ducts penetrating structural or architectural walls shall be sealed air and sound tight.

2.13 FIRE RATED SURFACE PENETRATIONS

- A. All ducts penetrating fire rated surfaces shall be sealed as directed in 230900.

2.14 EXPOSED ROUND +2" PRESSURE CLASS

- A. All joints and fittings shall be sealed with thermo-fit duct band by Raychem or approved equal. Contractor shall take care to ensure that all joints and fittings are neat in appearance.

2.15 DUCTWORK

- A. All ductwork shall be fabricated and installed in compliance with the latest SMACNA duct manuals.
- B. Sheet metal ducts shall be properly braced and reinforced with and, where they protrude above roof, they shall be properly flashed.
 - 1. Underground ductwork and fittings shall be constructed of fiberglass reinforced plastic and shall be all requirements of the 2018 IMC and listed with ICC-ES for direct burial application.
 - 2. All ducts and fittings shall bear labels indicating all code listings.
 - 3. All field joints shall be watertight and constructed per duct manufacturer requirements.

4. Duct and fittings shall be sand bedded.

2.16 DUCT JOINTS

- A. All duct joints must be sealed airtight as required by Table 1-2 "SEAL CLASSIFICATION" of the "HVAC Duct Construction Manual". The term "seal" or "sealed" means use of mastic or mastic plus tape or gasketing as appropriate.

2.17 DIMENSIONS

- A. Ducts, unless otherwise approved, shall conform accurately to the dimensions indicated on the drawings, and shall be straight and smooth on the inside with joints neatly finished. All duct sizes shown on the drawings are free area inside dimensions. Acoustically-lined ducts shall have outside dimensions increased as required to accommodate the acoustic lining specified and still maintain the free area inside dimensions shown on the drawings.
- B. Under no circumstances shall the cross section of any duct be decreased by dents, pipes, or hanger rods running through it unless otherwise indicated on the drawings. Neither shall the shape be changed without approval. No abrupt transitions that restrict the area shall be used. Where necessary to gain clearance, the duct seams may be turned inside. Structural and Architectural drawings shall be consulted for areas with restrictive clearances.

2.18 FIELD VERIFICATION

- A. No ductwork shall be fabricated without first field verifying that the available space (under actual job conditions) will permit installation of the ductwork without structural or other conflicts.

2.19 FLEXIBLE CONNECTION

- A. This contractor shall provide flexible connections not less than 4 inches wide, constructed of heavy, waterproof, woven plastic-coated glass fabric at the inlet and outlet connections of each fan unit, securely fastened to the unit and to the ductwork by a galvanized iron band, and provided with tightening screws. Corners shall be sewn tight shut.

2.20 AIR FLOW MEASURING DEVICES

- A. The sheet metal contractor shall install the air flow measuring devices as specified in Section 251000. The devices will be furnished by the control contractor.

2.21 BELT GUARDS

- A. Belt guards shall be fabricated and installed. Guards shall be constructed of 10-gauge wire, 1-inch mesh in 1-1/2-inch angle-iron welded frames. All guards shall be provided with an opening for a tachometer and shall be either the split type or easily removable for belt repair. The guards shall be anchored securely to the floor or walls to prevent any vibration.

2.22 PRE-MANUFACTURED DUCTS

- A. Runouts above ceiling from primary supply air ducts to VAV terminal boxes shall be rigid conduit.

- B. Runouts above ceiling from the terminal boxes to the ceiling diffusers shall be similar to "Genflex - Type IL". Maximum allowance length is 5'-0" in any given duct run. Duct to be factory fabricated with spring steel wire helix and 1" thick glass fiber insulation covered with external vapor barrier and lined with continuous non-perforated inner sleeve.
- C. Material shall comply with IMC Standard 10-1.

2.23 RECTANGULAR DUCT LINING

- A. The interior surface of all rectangular supply, return, fresh, relief, and exhaust air ducts (except where noted otherwise), shall be lined with 1" thick fiberglass dual density duct liner, having an average "K" factor of .24 BTU at 75 deg. F mean. The liner shall meet standards NFPA No. 90A and No. 90B and shall have the Underwriters' Laboratories, Inc., label.
- B. Duct liner shall be applied to the flat sheet with a 100% coverage of duct adhesive. The duct liner shall be cut to assure snug corner joints. The black surface of the liner shall face the air stream. On horizontal runs, tops of ducts over 12" in width and sides over 16" in height shall be additionally secured with welded pins and speed clips on a maximum of 15" centers. On vertical runs, gripnails or welded pins and speed clips shall be spaced on a maximum of 15" centers on all width dimensions over 12". Pins shall start within 2" of all cross joints within the duct section.
- C. Welded pins shall be cut virtually flush with the liner surface. Clips should be drawn down flush only and not so as to compress the liner and cause the leading edge of raise. All exposed edges and the leading edge of all cross joints of the liner shall be coated with adhesive.
- D. Material shall comply with 2021 IMC Standard 10-1.

2.24 FUME HOOD DUCTS:

- A. Fume hood ducts shall be all welded 316 stainless steel with welded joints and seams.

2.25 GAS VENTS

- A. Flues for gas-fired equipment shall be of the sizes shown on the drawings. Gas vent approved for continuous flue temperatures up to 1000 deg. F. Units shall be Metalbestos, Metalvent, or Dura-Vent.
- B. Top flues with Metalbestos Type "S-CT" vent cap especially designed for non-backdraft application. Flash and counterflash around flue at point of roof penetration to make watertight. Vertical and horizontal flues shall be double wall stainless steel construction.
- C. All flues must be of type approved by local gas company for application.

2.26 REGISTERS, GRILLES AND DIFFUSERS

- A. All registers, grilles, and diffusers located in toilet room areas shall be all aluminum construction.
- B. Supply Air Registers:
 - 1. Furnish and install all supply air registers shown and specified on the drawings. All units to have opposed blade balancing dampers. Registers to have 4-way air deflection. All register cores shall be removable, or plaster frames shall be furnished with units. Registers

shall be of steel, or anodized aluminum construction. Finish shall be bright white unless otherwise noted.

2. Registers shall be Titus, Tuttle & Bailey, Metalaire, Nailor, Carnes or Price.

C. Return, Exhaust & Transfer Air Registers:

1. Furnish and install all ceiling and sidewall return, exhaust, and transfer air registers shown and specified on the drawings. All units to be painted steel, or aluminum construction (where permitted by fire code) with bright white finish and opposed blade balancing dampers. All cores shall be removable, or plaster frames shall be furnished with units. Registers located near the floor shall be heavy duty gymnasium type. Registers shall be Titus, Tuttle & Bailey, Metalaire, Nailor, Carnes or Price.

D. Ceiling Diffusers:

1. All ceiling diffusers shall be of the round, square, or rectangular type with louvered face and 1, 2, 3, or 4-way air pattern as indicated on the drawings. Units shall be painted steel, or aluminum construction (where permitted by fire code) with bright white finish and inner assembly shall be easily removable from outer frame without special tools. Louvers shall be spaced on 1-1/2" centers maximum.
2. All diffusers shall be furnished with round or square opposed blade volume control and air extractor. Diffusers shall be Titus, Tuttle & Bailey, Price, Metalaire, Nailor, or Carnes.

E. General:

1. All registers, grilles, and diffusers located in locker/shower area shall be all aluminum construction.
2. Color and finish of all grilles, registers, and diffusers shall match ceiling grid. Coordinate with the Owner's representative.

2.27 LOUVERS

- A. At all air system openings in outside wall, install storm louvers.
- B. Construct louvers of aluminum with primer coat finish for field painting.
- C. Slats shall be inclined at least 45 degrees from the horizontal and overlap a minimum of 1". Slats over 40" long shall have a 2" wide intermediate support. The exterior face of the louver shall be neatly fitted to the building wall, flashed at top, and caulked at sides and bottom. New open area for air passage shall be at least 50% of the nominal size. On the inside face of the louver, install a removable screen, consisting of 1/2" mesh galvanized wire screen in a galvanized channel frame. The louver shall have a sub-frame and shall be removable. See plans for custom louvers required.
- D. Caulk around louver frames with clear G.E. silicone sealer after installation. Caulk color shall match color of surrounding material.
- E. Louvers shall be Airolite, Air Balance, Air Guide, American Warming, or Dowco.

2.28 PACKAGED ROOFTOP HEATING AND AIR CONDITIONING UNITS

- A. Furnish and install complete the roof-mounted packaged type Gas/DX cooling unit or cooling only unit, as shown and specified on the plans. Unit to be factory-wired and tested and of capacities as listed. the unit shall be shipped completely assembled, pre-charged, piped, and wired internally, ready for field connections. In addition, manufacturer shall provide field start-up and test for each unit and shall forward a copy of the start-up report to the Architect.
- B. The unit shall be complete with integrated economizer capable of simultaneous economizer and compressor operation. Economizer shall include all hardware and controls for cooling with outside air, low leakage dampers not to exceed 3% leakage at 1.0 in. wg pressure differential, capable of introducing up to 100% outside air and equipped with gravity relief air damper. Provide 0-10 VAC control points as required for ATC contractor.
- C. Gas-fired heat exchanger shall be constructed of aluminized steel. Power burner shall have electric direct spark ignition, 100% safety shut-off electronic flame sensing controls, pre-purging and combustion air adjustment. All controls shall be listed for operation at low outdoor air temperatures. System shall be equipped with dual limit safety controls, shall be AGA design certified for outdoor installation for natural gas firing, shall be rated and tested according to D.O.E. and F.T.C.
- D. Roof curb shall be of steel construction and shall extend 12" minimum above the finished roof surface. The mounting shall made to the bottom perimeter of equipment and distribute the unit weight uniformly to the structure.
- E. High- and low-pressure switches shall be factory-installed and wired. These switches shall protect the system against abnormal operating conditions. Low pressure switch shall be automatically reset, high pressure switch shall be manual reset.
- F. The unit shall be furnished complete with a field installed starting kit to aid the compressor when the compressor is starting under a condition of low voltage.
- G. All components, wiring, and inspection areas shall be completely accessible thru removable panels which have locking door handles.
- H. control points as required for ATC contractor.
- I. Provide factory filter bank status run meter with filter run time and clean/dirty
- J. Provide factory hail guards.
- K. Provide a factory mounted weather-proof 120-volt GFI outlet.
- L. Provide a factory terminal strip for DDC system connection.
- M. The compressor section shall carry a 5-year guarantee.
- N. Units shall be Rheem, York or Carrier.

2.29 PACKAGED HEAT PUMP UNIT

- A. Furnish and install complete the air-to-air split system packaged air conditioner shown and specified on the drawings.
- B. Evaporator section shall be ceiling mounted type with pre-charged refrigerant system, packaged controls, swing flow outlet air louvers, and packaged, integral, concealed drain pump. Unit shall be complete with filter section, hard wired, wall mounted thermostat, and all controls for automatic operation.
- C. Condensing unit section shall be complete with high performance hermetic compressor with high- and low-pressure safety controls, air cooled condenser with modulating fan controls for operation at outdoor air temperatures as cold as 0 deg. F. Provide hard wired, wall mounted heating/cooling thermostat, auto changeover and all controls for automatic operation.
- D. Heating section shall be electric.
- E. Unit shall be Lenox, Mitsubishi, LG, or approved equal.

2.30 UNIT HEATERS (Electric)

- A. Furnish and install in the locations shown on the plans the electric unit heater shown and specified. Each unit to have capacity, air delivery, fan type, and motor characteristics as shown on the plans.
- B. Unit casings shall be of not less than 16 gauge steel. All casings to be phosphatized for rust resistance and finished with a baked enamel. All hardware shall be plated for rust resistance.
- C. Motors and fans shall be designed for unit heater service and shall be tested for continuous duty as applied on each size to eliminate vibration and minimize sound.
- D. Horizontal delivery units shall be equipped with formed louvers, 4-way individually adjustable.
- E. Units shall be furnished with factory disconnect, 2-stage room thermostat (fan only and fan & heat) and all controls for automatic operation.
- F. Unit heaters shall be Markel, Chromalox, Raywall, Intertek or approved equal.

2.31 LABORATORY FUME HOOD

A. SCOPE AND CLASSIFICATION

- 1. This specification covers the requirements for the purchase of bench mounted pass-through laboratory fume hoods for use with remote exhaust blower systems.
- 2. Bench-mounted laboratory fume hoods in 5-foot width, internal depth of 23.9", and external depth of 33.4" is required.
- 3. This specification sets the intent for quality, performance, and appearance.

B. PERFORMANCE REQUIREMENTS

1. General Design Requirements
 - a. Fume hoods shall function as ventilated, enclosed workspaces, designed to capture, contain, and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.
 - b. Fume hood shall be factory designed to function as a by-pass fume hood.
 - c. Structure and Materials of construction
 - 1) Hoods are of double wall construction.
 - 2) Powder-coated, cold rolled steel exterior
 - 3) Galvanized steel support members
 - 4) Sheet molded composite panel internal liner.
2. Baffles
 - a. Moving or adjustable baffles are not acceptable.
3. Sash
 - a. Two independent sashes of 3/16" tempered safety glass.
 - b. Maximum opening is 28".
 - c. Unobstructed viewing height is 37.5".
 - d. Hood incorporates perforated sash handles to bleed air into the hood chamber directing fume concentrations away from the user's breathing zone.
4. Airfoil:
 - a. Hoods are provided with airfoils across the bottom of the sash areas that allows airflow into the hood regardless of user's position.
5. Besides the exhaust blower, no additional blowers are required for specified containment.
6. Access for maintenance is from both the faces and exterior sides of the hood.
7. Services:
 - a. Hood manufacturer shall furnish and deliver all service outlets, accessory fittings, electrical receptacles, and switches, as listed in these specifications, equipment schedules or as shown on drawings.
 - b. Plumbing fittings mounted on the fume hood superstructures shall be pre-plumbed
 - c. Final plumbing and electrical connections are the responsibility of those contractors' fulfilling requirements of Divisions 22 and 26.

- d. All electrical services are pre-wired to a single point internal junction box at the top right of the hood.
 - e. Hoods without service fixtures must pass through a 34" opening without disassembly.
8. Efficiencies
- a. Noise Criterion: The hood shall have a Noise Criterion (NC) rating of less than 50; measured 36" in front of the hood with full open sash, at 100 fpm face velocity.
 - b. Illumination: Shall be a minimum average of 80 foot-candles inside the work area.

C. QUALITY ASSURANCE

- 1. Fume hoods shall be designed, including comprehensive engineering analysis, by a qualified, licensed Professional Engineer.
- 2. The laboratory hoods must conform to the following regulations and standards.
 - a. SEFA 1, Scientific Equipment and Furniture Association, Recommended Practices for Laboratory Fume Hoods
 - b. NFPA 45, National Fire Protection Association, Fire Protection for Laboratories Using Chemicals
 - c. ASTM E84-09C, ANSI 2.5, NFPA 255, UL 723, UBC 8-1 (42-1), Standard Test method for Surface Burning Characteristics of Building Materials
 - d. ASHRAE 110, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Method of Testing Performance of Laboratory Fume Hoods
 - e. ANSI/ASSP Z9.5 American Society of Safety Professionals, Laboratory Ventilation
 - f. OSHA, Federal Register 29 CFR Part 1910, Occupational Safety & Health Administration, U.S. Department of Labor, Occupational exposures to hazardous chemicals in laboratories.
- 3. Fume hoods shall be Made in America
 - a. 95% or more of raw material and component suppliers shall be United States based.
 - b. Stainless and cold rolled steel used in manufacturing shall be sourced from United States steel mills.
 - c. Final product must be fabricated and assembled within the United States of America.
- 4. Supply all equipment in accordance with this specification. Offering a product differing in materials, construction, or performance from this specification requires written approval obtained seven days or more before the proposal deadline.

5. Manufacturer's warranty against defects in material or workmanship on its fume hoods will be for 1 year from date of installation or 2 years from date of purchase, whichever is sooner, and includes replacement of parts (except lamps) and labor.

D. SUBMITTALS

1. Action Submittals

- a. Laboratory hood specification sheets and product manuals shall be submitted by the hood manufacturer upon request and include safe and proper operation and maintenance information.
- b. Shop Drawings: Include plans, elevations, sections, and details.
 - 1) Indicate locations and types of service fittings together with associated service supply connection required.
 - 2) Indicate duct connections, electrical connections, and locations of access panels.
 - 3) Include roughing-in information for mechanical, plumbing, and electrical connections.
 - 4) Provide face opening, volumetric rates, and static pressure drop data.
- c. Submit a document detailing the information supplied on the Hood Safety Practices Label to verify compliance to specifications.

E. MANUFACTURERS

1. Basis-of-Design Product: Labconco Protector Pass-Through Fume Hood

F. MATERIALS

1. Hood Interior Liner and Baffle

- a. Liner material must comply with UL 1805, and be listed within NRTL test report as proof of compliance.

2. General Material Properties

- a. Nonflammable, corrosion and chemical-resistant
- b. Sheet molded homogenous polyester panels
- c. Minimum thickness is 3/16"
- d. Smooth, white finish
- e. Flame and Smoke Characteristics
- f. Flame retardant, self-extinguishing, with a flame spread rating of 25 or less in accordance with ASTM-E84

- g. Smoke Density: 115
3. Sheet Steel
- a. Side panels and access panels 20-gauge (or heavier) sheet steel.
 - b. Hood corner posts are 16-gauge sheet steel.
 - c. Ceiling enclosure panels are 18 gauge sheet steel.
 - d. Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M.
4. Chemical Resistant Finish
- a. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling.
 - b. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Third party validation required.
 - c. Powder-coat process required. Paint processes that release Volatile Organic Compounds (VOC) are not acceptable
 - d. Color for Fume Hood Finish:
 - 1) Glacier White
5. Safety Glass
- a. Tempered
 - 1) Clarity and temper test to be as specified in latest edition of Glass Tempering Association, Engineering Standards Manual, Section 8.1.
 - 2) Surface and interior visible quality to be as specified per ASTM C 1036, Standard Specification for Flat Glass, Table 4, Quality level Q3.

G. CONSTRUCTION

1. Superstructure:
- a. Self-supporting, rigid structural assembly, to support inner wall consisting of fume hood liner and outer wall of sheet metal exterior.
 - b. Fabricated from galvanized steel.
 - c. Space shall accommodate fume hood wiring and plumbing components for service fixtures.
 - d. Access to fixture valves concealed in wall provided by exterior removable access panels or through removable access panels on the front posts.

2. Exterior
 - a. Fabricate from steel sheet with component parts screwed together.
 - b. Apply chemical-resistant finish to interior and exterior surfaces of component parts before assembly.
 - c. Interchangeable side panels shall lift off without the use of tools to allow access to plumbing lines, service fittings, electrical wiring, counterbalance sash weights, and light fixtures. Exposed fasteners or hardware, and Velcro type fasteners, are not acceptable.
 - d. Corner posts
 - 1) Pre-punched and plugged to accommodate up to 4 service fixtures per corner post.
 - 2) All services are accessible from the front of the hood.
 - 3) Aerodynamic shape
 - 4) Accommodate two electrical duplexes per corner post.
 - 5) Right hand corner post includes electrical switches and pre-cut for Airflow monitor installation.
 - 6) Un-used penetrations shall be plugged.
3. Top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.
4. Panel above header shall be removable without the use of tools to allow access to mechanical connection, electrical wiring, counterbalance sash weights, and light fixtures. Exposed fasteners or hardware, and "hook-and-loop" type fasteners, are not acceptable.
5. Dimensions
 - a. Overall exterior dimensions are as follows:
 - 1) 5 foot nominal width: 60" w x 59" h x 33.4" d
 - b. Overall interior dimensions are as follows:
 - 1) 5 foot nominal width: 50.1" w x 48" h x 23.9" d
6. Hood Liner
 - a. Adhere interior liner components to superstructure.
 - b. Stainless steel fasteners shall be used on the interior ceiling for structural integrity.
 - c. Fasteners exposed to chemical environment are not acceptable.

- d. Punch fume hood lining side panels to receive four service fittings, for use with remote controls, per side. Provide removable plug buttons for holes not used for indicated fittings.
7. Hood Baffle
- a. The baffle system shall be constructed with the same material as the fume hood liner.
 - b. The baffles shall be removable for cleaning.
 - c. Exposed components to be non-metallic. Metal components exposed to chemical environment are not acceptable.
 - d. Moving parts or adjustment of any kind is not acceptable.
8. Exhaust Connection
- a. Stainless steel with Chemical-Resistant Finish
 - b. 12.81" ID to accommodate any 12" nominal duct without the need for a transition adapter. Additional components required to accommodate 12" nominal mechanical system are not acceptable.
 - c. Ducting shall go inside the duct collar to ensure condensate travels into the hood and evaporates. Duct collars that allow duct connection over the collar are not acceptable.
9. Airfoil
- a. Cold Rolled Steel with Chemical-Resistant Finish.
 - b. Airfoils are required on each face of the fume hood.
 - c. Airfoils shall have an aerodynamic radius to sweep the air into the hood with minimal turbulence. Airfoil directs airflow across work top to remove heavier-than-air gases.
 - d. Must have 5 rows of perforations to allow the air to bypass underneath and through the foil and sweep across the work surface to prevent any back flow of fumes escaping from the front of the hood opening. This airflow continues even if blocked by the presence of the operator.
 - e. Foil must extend back under the sash to prevent closure of the lower by-pass opening when the sash is in the fully closed position, directly on top of the airfoil.
10. Sash Assembly
- a. Glass: Fully tempered safety glass with unobstructed, side-to-side view of fume hood interior and service fixture connections.
 - b. Dimensions: The full sash opening height is 28", the total unobstructed viewing height is 37.5" measured from the work surface.

- c. Sash Tracks: Steel with Chemical Resistant Finish. Shall include bump stops for opening and closing.
- d. Sash Handle: extruded aluminum with Chemical Resistant Finish. Sash handle includes a perforated air passage directly atop the handle to bleed air into the hood chamber and direct chemical fumes away from the user's breathing zone. The handle is ergonomic in design and is easy to grasp when operating
- e. Sash guides: Corrosion resistant extruded poly-vinyl chloride.
- f. Sash System
 - 1) Vertical Sash
 - a) Hoods have two single vertical sashes counterbalanced by independent sash weights suspended by two vinyl-coated stainless steel cables that pass-through ball bearing pulleys.
 - b) Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure.
 - c) One defeatable sash stop on each face to restrict sash opening height to 25".

11. Electrical Components

- a. Lighting
 - 1) Provide UL Listed, high-efficiency, quick-start, T8 Fluorescent lighting systems, including bulbs.
 - 2) 5 Foot Hoods - 2 each, Fluorescent lamps
 - 3) Vapor-Proof: all electrical components shall be outside of the contaminated air space. Lighting shall be located behind a laminated safety glass shield, sealed to the top of the hood liner.
 - 4) The Fluorescent light assemblies shall be serviceable from outside the fume hood cavity, without the use of tools.
 - 5) Light switch to be included on the lower right corner post, at heights compliant with the Americans with Disabilities Act (ADA).
- b. Blower Switch
 - 1) Hoods shall be provided with one blower switch, on the lower right corner post of the front face, at heights compliant with the Americans with Disabilities Act (ADA).
- c. Electrical Receptacles
 - 1) The hoods shall accommodate up to two (one per corner post) electrical receptacles as indicted in schedule or drawings.

- 2) Cover plates shall be acid resistant thermoplastic.
- d. Wiring
- 1) Every electrical component shall be individually wired to a single point internal field wiring box (including individual duplexes/receptacles).
 - 2) Field wiring box to be 7" x 4" x 2.5", grounded, and have (12) 7/8" diameter knock out penetrations.
 - 3) Final wiring and circuit dedication is to be by others.
- e. Fume hood to have third party validation of compliance to UL 1805 and UL 61010-1 by a Nationally Recognized Testing Laboratory (NRTL)
- f. The fume hood features a sash alarm to ensure only one sash is open at a time. If the second sash is raised, an audible alarm will sound until one sash is closed.
- g. Hood Safety Practices Label: Corrosion resistant plate attached to the left corner post of the fume hood with the following Hood Safety Practices:
- 1) For use with substances that produce hazardous levels of airborne chemicals: gas, fumes, vapors, dust
 - 2) Do not put your head in the hood.
 - 3) Minimize drafts and sudden movements in front of the hood.
 - 4) Work a minimum of six inches inside the hood.
 - 5) Elevate equipment above the work surface.
 - 6) Keep sill and baffle unobstructed.
 - 7) Do not use the hood for storage.
 - 8) Adjust the sash to smallest opening possible when in use.
 - 9) Close sash when unattended.
 - 10) Do not remove any of the hood components.
 - 11) Do not place flammable solvents near heat, flame or sparks.
 - 12) Do not evaporate large amounts of flammable liquids.
 - 13) Wipe up spills immediately.
 - 14) Routinely validate airflow.
 - 15) If the ventilation system malfunctions, or airflow alarm indicates unsafe condition, close sash and discontinue hood operation immediately-call for help.

- 16) Do not use with Biohazards or Perchloric Acid

H. Fume Hood Accessories

1. Service Fixtures: Color-coded hose nozzle outlets and valves mounted inside the fume hood and controlled from the exterior with color-coded index handles
 - a. Provide with fixtures listed in schedule
 - b. Hose connectors located inside the fume hood cavity are chemically-resistant, glass-filled polypropylene with 6 serrations.
 - c. Service lines shall be factory installed from valve to outlet
 - 1) Copper tubing unless otherwise noted
 - 2) Brass service lines for gas
 - 3) Connections shall be made with quick-connect compression fittings on the inlet and outlet of the valve body, soldered and brazed connections not easily disassembled are not acceptable.
 - 4) Services pre-piped to the top of the hood.
 - d. Valves
 - 1) Extruded brass valve and rotating seat, TFE-coated silicone bronze stem and TFE packing.
 - 2) Fixture handles are plastic and color coded as well as labeled for the designated type of service.
 - 3) Fixtures are rated at maximum pressure of 200 psi.
 - 4) Valves are front loaded, located on the fume hood corner post for remote use.
2. Ceiling Enclosure Panels:
 - a. Provide 4-sided filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods and extending from tops of fume hoods to above ceiling.
 - b. Exposed fasteners are not acceptable.
3. Face Velocity Monitor/Alarm
 - a. Digital Airflow Monitor
 - 1) Provide audible and visual alarm in the event of an unsafe face velocity.
 - 2) Alarm must sit flush with the fume hood corner post.

- 3) Based on a thermally compensated thermistor in the alarm module, and air passing through a separate airstream into the hood interior.
- 4) Velocity shall be displayed digitally on the user facing LCD in fpm or m/s.
- 5) LED lights display red for alarm, yellow for caution, and green for normal operation.
- 6) Must include external alarm and night setback functions.
- 7) Alarm mute shall be accessible from the front of the monitor; visual alarm must remain activated until alarm condition is corrected.
- 8) UL Listed electrical components.
- 9) Calibration shall be through a menu driven step by step procedure.
- 10) Calibration is the responsibility of the owner, following a complete balancing of the mechanical system, and concurrently with As-Installed testing.

I. Work Surface

1. 1.25" thick, molded from solid modified epoxy resin, with smooth, non-specular, black finish.
2. One inch radius front edge for optimal fume hood performance.
3. 3/8" dished area to match the fume hood interior work space and form a water tight pan for spill containment.
4. Include a 2.5" diameter hole on each side for service pass-through and piping. Hole to be covered by hood superstructure upon installation.
5. Physical Properties:
6. Flame-Spread Index: 25 or less per ASTM E 84.
7. Cupsink
 - a. 3 x 6" dimension, polypropylene construction
 - b. Provide with strainers and tailpieces, NPS 1-1/2 (DN 40)
 - c. To sit flush with dished area of work surface
 - d. Cupsink to be located. Left side.

J. Supporting Base Cabinets

1. Exterior construction is 18-gauge (or heavier) cold rolled sheet steel with Chemical Resistant Finish.
2. Hinges are 10 gauge (or heavier) plate with self-clinching pilot pin. Knuckle, bullet, or piano type hinges are not accepted.

3. The rear panel will feature a 12" x 8" removable plumbing access panel.
4. Units 24" wide or less have only one door.
5. Each cabinet includes four leveling feet.
6. Capable of supporting up to 800 pounds.
7. A filler panel is required to increase the cabinet depth to work surface depth.
8. Standard Storage (Non-chemical)
9. Overall exterior dimensions:
10. 48" 48" w x 22" d x 35.5"-36.75" h
11. Flush pull handles are ABS, low gloss black.

2.32 EXHAUST FANS

A. Roof Mounted Type:

1. Furnish and install complete the low-profile roof mounted exhaust fans of the size and capacity shown on the drawings.
2. Roof mounted fans shall be of the centrifugal type with spun aluminum hood. All parts exposed to weather and all fastenings shall be either aluminum or stainless steel. All fans to be equipped with permanently lubricated two-speed (where specified) ball bearing motors located in separate compartment out of the air stream. Fan shall have adjustable V-belt drive, self-flashing insulated curb, backdraft dampers, bird screen, disconnect switch, and shall be complete with all necessary fittings and transition pieces for a complete installation. All units shall bear the AMCA certified performance seal.
3. Fans shall be Greenheck, Twin City, Cook or Penn.

B. Ceiling Type:

1. Furnish and install complete the ceiling mounted exhaust fans shown and specified on the drawings.
2. Fan shall have acoustically insulated housing for quiet operation. Air deliveries shall be as indicated on the drawings and shall be certified by AMCA performance tests.
3. Fan shall have centrifugal wheel direct connected to motor. Ceiling grille shall be all aluminum construction with satin finish. Entire fan, motor, and wheel assembly shall be removable without disturbing the housing. Fan speeds shall not exceed 1100 RPM. Unit shall be complete with backdraft damper.
4. Fan shall be Greenheck, Twin City, Cook or Penn.

2.33 DRYER BOX:

- A. Recess wall type for stud frame or CMU wall. 22 Gauge aluminum construction.
- B. Dryer box shall be by Dryerbox or equal

2.34 AIR FILTERS

- A. Provide one complete set of spare filter media (in addition to the new filters installed at time of acceptance) for each unit filter bank and store on site as directed by Architect.
- B. Air filter banks shall be Cambridge, AAF, or Eco-Air.

2.35 HVAC SMOKE DETECTORS

- A. All units above 2000 CFM shall be provided with smoke detectors located in the return air intake and supply air discharge as per IMC. Detectors to be provided and wired under Section 26. ATC contractor to install all detectors.
- B. Duct smoke detectors shall not be installed until just prior to final inspection to prevent dust and debris from contaminating detector.

2.36 FUSIBLE LINK FIRE DAMPERS

- A. Furnish and install complete the fire dampers shown on the plans and specified herein. Dampers shall be provided and installed in accordance with NFPA-90A and bear the UL Label of Approval. Fire and ceiling radiation dampers shall be curtain-type with fusible link located in the air stream. Submit installation drawings.
- B. Spring catches shall hold the dampers in a closed position when F.L. is broken. The weight of the duct and mounting frames shall comply with the National Board of Fire Underwriters and approved installation drawings. Sleeves with angles are required at all locations.
- C. Provide hinged, gasketed, and latched access panels in duct at each damper. Stencil "Fire Damper" in 1" high red letters on white background at each access panel.
- D. Provide ceiling access panels approved by the Owner's representative at each duct access panel when required, for maintenance and inspection of the fusible link.
- E. Fire dampers shall be Air Balance, Pottorff or Nailor.

2.37 DAMPERS – GENERAL

- A. Damper frames shall be of not less than 18-gauge galvanized steel, formed for extra strength, with mounting holes for enclosed duct mounting.
- B. All damper blades shall be of not less than 16-gauge galvanized steel formed for strength and high velocity performance. Blades on all dampers must be of not over 6" in width. Blades shall be secured to 1/2" diameter zinc-plated axles by zinc-plated bolts and nuts. All blade bearings shall be nylon. Blade side edges shall seal off against spring stainless steel seals. Teflon-coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and insure smooth operation. All blades linkage hardware shall be constructed of corrosion-resistant, zinc-plated steel and brass.

2.38 AUTOMATIC DAMPERS

- A. The ATC contractor shall furnish all automatic control dampers. The sheet metal contractor shall install all dampers and transition all ductwork to the dampers.

PART 3 – EXECUTION

3.1 JOB SITE CONDITIONS

A. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that the work of this section may be installed in accordance with all pertinent codes and regulations in the approved shop drawings.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Architect.
2. Do not proceed with installation in areas of discrepancy, until all such discrepancies have been fully resolved.

3.2 INSTALLATION OF EQUIPMENT

- A. Install all equipment with adequate space for service and maintenance. **Minimum of 30” clearance for all service and control access.**
- B. All visible surfaces behind grilles and registers shall be painted flat black.
- C. Care shall be taken to avoid interference with structure and the work of other trades. Do not cut into load carrying members without the approval of the Owner's representative.

3.3 INSTALLATION OF DUCTS

- A. All ducts shall be installed in compliance with the latest editions of the SMACNA manuals.
- B. All necessary allowance and provisions shall be made in the installation of sheet metal ducts for the structural conditions of the building, and ducts shall be transformed or divided as may be required. Whenever this is necessary, the required area shall be maintained. All changes, however, must be approved and installed as directed.
- C. Pre-manufactured ducts shall be connected to rigid ducts and equipment with the solid wraps of fabric duct tape and tyton bands drawn tight to form an airtight joint.
- D. During the installation, the open ends of all ducts shall be protected by covering with plastic sheet tied in place to prevent debris and dirt from entering.
- E. Install this work in cooperation with other trades so that there will be no delay in progress of construction work. It is extremely important that the duct system be clean before final connections are made to the air devices.
- F. The contractor shall take special care when running exposed ductwork to ensure that the final installation is neat in appearance.
- G. Spiral ducts running exposed in occupied areas shall be hung with an aircraft cable type hanger, or single duct strap at center of duct.

- H. Under no circumstances shall ductwork be supported from the metal roof deck. (See general requirements 230100 & 230900)
- I. Ceiling outlets shall be rigidly supported from the overhead structure with G.I. wires or straps, or from rigid galvanized iron ductwork. Outlets shall not be supported from T-bar ceilings or metal roof deck.
- J. Hanger and Supports:
 - 1. Hangers for ducts up to 18" in width shall be placed on not more than 8'-0" centers. Ducts 19" and over in width shall be supported on not more than 4'-0" centers. Hangers shall be placed plumb and present a neat appearance. Construct hangers from galvanized band iron 1" x 1/8" for duct up to 36" wide. Hangers shall extend down the sides of the ducts not less than 9". On ducts less than 9" in depth, hangers shall extend the full depth of the ducts. Attach hangers to ducts using not less than three rivets or parker screws of appropriate sizes. It is essential that all ducts be rigidly supported. Where vertical ducts pass thru floors or roofs, supporting angles shall be rigidly attached to ducts and to the structure. Angles shall be galvanized and of sufficient size to support the ductwork rigidly. Place supporting angles on at least two sides of the duct. For round ducts, strap hangers shall extend completely around ducts.
 - 2. Ceiling outlets shall be rigidly supported from the overhead structure with G.I. wires on straps, or from rigid galvanized iron ductwork. Outlets shall not be supported from T-bar ceilings unless approved by the owner's representative.
- K. Ducts at Masonry:
 - 1. Where ducts are shown connecting to masonry openings and along edges of all plenums at floors and walls, provide a continuous 2" x 2" x 3/8" galvanized angle iron which shall be bolted to the construction and made airtight to the same by applying caulking compound. Sheet metal at these locations shall be bolted to the angle irons.

3.4 STORAGE OF DUCTS

- A. Ductwork shall be stored in a protected area to prevent physical damage to the duct liner, and to ensure that the duct liner is not exposed to excessive heat or moisture which would deteriorate the air side surface.
- B. Ductwork which has been improperly stored and/or sustained physical damage will be rejected and shall be removed from the job site as directed by the Owner's representative.

3.5 CLEANING OF DUCTS

- A. Before ducts are insulated and before the ceiling is installed and final connections made to the air devices, the rooftop unit fan shall be operated at full capacity to blow out any dirt and debris from ducts. If it is not practical to use the main supply blower for this cleaning, the ducts may be blown out in sections by a portable fan. After the ducts have been cleaned and initially pressure tested, the final connection shall be made to the air devices.

3.6 TESTING OF DUCTS

- A. Supply, return, and exhaust ducts, plenums, and casings operating at duct pressures from +2" to -2" shall be tested and made substantially airtight at static pressure indicated for the system before

covering with insulation or concealing in masonry. Substantially airtight shall be construed to mean a leakage rate less than 5% of the rated airflow.

- B. Supply air ducts operating at pressures above +2" shall be tested and made substantially airtight. Leakage shall be less than 1% of the rated air flow.
- C. Ducts including all flexible runouts shall be tested in accordance with SMACNA Duct Construction Standards.
- D. After the vertical duct risers or branch ducts have all been tested and tied into the mains, and after the rooftop unit has been installed, the mains shall be tested in accordance with SMACNA Duct Construction Standards.

END OF SECTION

SECTION 25 1000 - AUTOMATIC TEMPERATURE CONTROLS

PART 1 – GENERAL

1.1 GENERAL CONDITIONS

- A. The General Conditions, Supplementary General Conditions, alternates and addenda, applicable drawings and the technical specifications, shall all apply to all work under this division.

1.2 SCOPE OF WORK

- A. The scope of work shall include all labor, material, and equipment necessary to supply an automatic temperature control system for the facility. The Contractor under this heading shall furnish and install a complete direct digital control system as specified.
- B. Contractor shall provide at time of bid a statement of compliance including, but not limited to:
 - 1. Detailed points list.
 - 2. Any deviations from base specification with listed costs.
- C. Install a new complete, fully programmable, customized Direct Digital Control (DDC) system for control of the systems. This DDC control system shall be configured to operate over the district wide network.
- D. Provide the following:
 - 1. Demolition of existing systems
 - 2. Master DDC Control Panel
 - 3. Local DDC Control Panels
 - 4. ATC Interface Panels
 - 5. Local Area Network Wiring & Setup
 - 6. Room Temperature Control
 - 7. Building Fire Alarm Interlocks
 - 8. Packaged Rooftop Unit Controls
 - 9. Air Conditioning Split Systems
 - 10. Exhaust Fan Control
 - 11. Main water flow alarm
 - 12. IDF, MDF Temperature alarms
 - 13. Fire riser and main water line room temperature alarm
 - 14. Energy Reporting here in.
 - 15. Alarming as specified here in.
 - 16. 120-degree Domestic Hot Water System Control

1.3 SYSTEM DESCRIPTION

A. BASE BID SYSTEM

- 1. A web based, password protected DDC automatic temperature controls shall be furnished and installed as a part of this contract to give the owner a completely operable system.
- 2. Acceptable manufacturer and installers:

a. **EcoStruxure, as supplied and installed by UTAH YAMAS Controls, Inc. SLC.**

- b. **ABB Cylon Smart Building Controls, as supplied and installed by D & L Electric Control Company, Inc. Pleasant Grove.**
 - c. **Delta enteliWEB as supplied and installed by Atkinson Electronics, SLC.**
 - d. **WebCTRL as provided by Automated Logic, and installed by Control Solutions Group, SLC.**
3. Bidders must comply with all requirements of bidding documents to remain consistent with the district wide automation system. Any deviation or alternations will not be permitted. No substitutions or variances from the bid documents or the approved installers and/or manufactures will be permitted.
- B. All systems, components and programs/programming licensing shall be provided to Jordan School District for a period of no less than 15 years as a part of this bid.
 - C. All software upgrades and updates available shall be provided to Jordan School District for a period of no less than 15 years as a part of this bid.
 - D. **A detailed points list shall be provided by the contractor with their bid.**
 - E. DDC system shall be configured and connected to the district Ethernet/Network. System shall be accessible from any remote site through an Ethernet or internet connection. All functions, programs and control system parameters shall be accessible and fully functional through the district network. The ATC contractor shall supply and install all required hardware and software to permit full access to the DDC system at the new school as well as every same manufacture system throughout the district. All controllers shall be LON or open Native BACnet and freely programmable. Controllers with canned programming are not permitted.
 - F. The entire building automation system shall tie into JSD Lan Network automated server. The ATC contractor shall include all software and hardware to permit district wide network and complete intranet access to the DDC system. This includes graphic pages, per Jordan's District standards, monitoring, alarming, trending, programming, database modifications, setpoint changes, DDC programming. All aspects and elements of the DDC control system shall be available across the entire district network. The use of PC anywhere, or similar remote software, or lick portal packages is not acceptable.
 - G. The system shall be as indicated on the drawings and specified herein. Building HVAC systems and unitary heating devices shall be entirely controlled by the DDC system. System shall include local DDC controllers mounted at each fan system, etc. These local DDC controllers shall be interconnected by a 2-wire or 3-wire LAN (local area network) with a master/central DDC controller located in the main mechanical room or as directed by owner. The master/central DDC controller, in turn, shall communicate with both the existing school district host computer located in the district offices and a man-machine interface device located in the Main Custodian office. This interface device shall be a Pentium based computer as specified below. Device shall display on separate, bit-mapped color screens each fan system, Each screen shall have available for display in the appropriate location each input and output point monitored or generated by the DDC system. All digital output points shall have override capability. All screens shall be password protected so that sensitive data cannot be easily corrupted by inexperienced operators while allowing complete access to trained maintenance personnel. All of the above screens, data and features shall also be available for monitoring and modification from the Host computer located in the District offices via Networking (Ethernet) connections.

- H. The latest technology DDC/Energy Management systems will be furnished and installed. As a standard, these systems will include graphics and data files for each building at the Jordan's School District maintenance office.
- I. The DDC/Energy system will be capable of different access levels for the different control and engineering functions of the system. The Jordan's School District maintenance staff will have access at the highest level to allow for DDC program, graphic pages, and other changes and additions.
- J. The DDC/Energy Management system will have dynamic alarm display capability. If an alarm should occur at a remote location or system, that alarm shall generate a message on whatever screen happens to be on the current display. All alarms shall be logged on the system printer. The system will be capable of printing logs and trends. It will also be capable of displaying graphic trend information for all points. Reference the alarm requirement section for more details on the energy alarms and system alarms.
- K. The DDC/Energy Management system will have a graphic and/or text page for each major mechanical piece of equipment or system (I.E.: rooftops, fans, etc.). From these pages, there will be "live" readouts of temperatures, pressures, RH levels, on/off status, valve and damper positions, outside air temperature, etc. It shall be possible from this screen to perform setpoint changes, equipment on/off overrides, implement "test" status and values, without additional screen or program manipulation. Functions such as equipment schedules and reset schedules shall be accessed from editing screens. All functions shall be protected with different levels and passwords.
- L. There will also be a floor plan(s) which will show the location of rooms, room sensors, etc., and will give a "live" display of the current condition of that location. Room temperatures will be adjustable from this graphic. Outside air temperature will also display on this graphic. Larger buildings will require more than one of these floor plan pages. No more than 40 points should be on any one page.
- M. All system and unitary controls shall be of the direct digital type (DDC). Self-tuning PID (Proportional, Integral, Derivative) control algorithms shall be applied where applicable on all applications. The control system shall be a networked, distributed intelligence system, with the control loops for each system being capable of stand-alone operation.
- N. The system shall include all control devices, valves and damper parts as called for hereinafter.
- O. Division 25 contractor is required to supply and install a 3/4" EMT conduit system for the DDC control system at all areas with the exception of the ceiling plenum. 3/4" EMT conduit shall be installed at all wall areas, hard ceiling areas, exposed ceiling areas, mechanical rooms & rooftop equipment.
- P. Division 25 Contractor shall provide raceways and boxes for all Building Automation System components, including but not necessarily limited to the following:
 - 1. All BAS Box and raceway rough-in for all walls, regardless of construction, from the electrical box to above the ceilings as shown on the Mechanical and/or Plumbing drawings. This includes but is not limited to: thermostats, push button mushroom switches, kitchen panels, etc.
 - 2. Any raceways required for Network or BAS communications from the Structure containing the Head end equipment to any outlying structures, equipment, and/or locations that require BMS communication. This includes but is not limited to outbuildings, concessions, generators, cooling towers, boiler rooms, fan rooms, etc.

- Q. All ATC / BAS conduits, connections, etc. shall be white, 3/4" EMT.
- R. Plenum rated wire with permanent label may be installed above areas with lay-in ceilings by Division 25.
1. Plenum rated cable may be used in lieu of conduit above drop-in ceilings.
 2. Cables shall be run neat and straight, above ceiling without sagging.
 3. Cables shall not rest on or be supported by the ceiling.
 4. Cables shall be grouped according to system. Grouped cables shall be Velcroed together, **zip ties shall not be allowed.**
 5. Velcro straps shall be tagged with the various system and identified on 20-foot centers.
 6. Cables shall not receive excessive force when being installed.
 7. Cables that have been damaged during installation shall be replaced at contractors' expense. Contractor shall verify that all connections are in proper working order, terminated correctly and provide documentation to engineer prior to final walk through.
 8. All cables being run (not in conduit) shall, as a minimum standard, be listed and appropriately labeled as being resistant to the spread of smoke and fire in accordance with applicable article of NFPA-70 (NEC).
- S. Wireless devices or systems **WILL NOT** be accepted.

1.4 WORK TO BE PERFORMED BY OTHERS

- A. Division 26 shall furnish and install all single phase and multiple phase electrical power wiring to magnetic starters, disconnect switches, VFD's and motors. Division 26 shall also provide 120 VAC, 20 Ampere power sources to each group of ATC panels and VAV boxes as shown. The ATC contractor shall be responsible for all step-down transformers and 24 VAC wiring to ATC equipment.
- B. Division 26 shall furnish all duct smoke detectors. Refer to Duct Detectors in this specification for the ATC contractor responsibilities.
- C. Division 26 shall make final connections to JSD security alarm systems.
- D. The sheet metal contractor shall install all dampers supplied by the ATC contractor. Each damper shall be installed so that it will operate freely and without binding. To ensure that the damper both opens and closes completely with less than 7#/sq. ft. torque applied at the operating shaft, each damper shall be checked after its installation, but before the damper actuators are attached. Dampers not properly installed or meeting this torque requirement shall be replaced and/or reinstalled without additional cost to the ATC contractor or the Jordan's School District.
- E. The mechanical contractor shall install all valves, immersion wells and pressure taps supplied him by the ATC contractor.

1.5 INSTALLATION BY AUTOMATIC TEMPERATURE CONTROL (ATC) CONTRACTOR

- A. The successful control contractor shall furnish and install all necessary electrical control wiring for the complete temperature control system, heating and ventilating equipment motor starting circuit controls and all electrical control interlocks for same, and for control wiring for miscellaneous HVAC equipment furnished by the Owner.

- B. The ATC contractor shall be a licensed Electrical Contractor in the State of Utah with full time Master, Journeyman and apprentice electricians. If the ATC subcontracts the installation, it shall be to a licensed Electrical Contractor in the State of Utah. Full-time Master, Journeyman and apprentice electricians shall be utilized for the installation.
- C. The ATC contractor shall furnish & install all necessary electrical control wiring for all temperature controls, heating and ventilating equipment motor starting circuit controls, all electrical control interlocks for same and for miscellaneous packaged equipment as defined within this specification. Full-time Master, Journeyman and apprentice electricians shall be utilized for the installation.
- D. When connecting to controllers, valves etc. that have no provisions for EMT connections, EMT may terminate in a junction box located within 36" of the controller or control valve. When making a transition between EMT and plenum cable, protect cable from abrasion by installing an insulating connector or equivalent on the exposed end of the EMT. Full time employees holding Master, Journeyman and apprentice electrician licenses in the State of Utah shall be utilized for the installation.
- E. Plenum rated cable may be used in lieu of conduit above drop-in ceilings per 1.3.Q.
- F. All ATC rough-in boxes shall be identified with the letters "ATC" written across the inside of the box with permanent marker. In addition, each ATC cover plate shall be painted white with the letters "ATC" stenciled in black.

1.6 QUALITY ASSURANCE

- A. Provide an unconditional **TWO-YEAR** parts and service warranty. This warranty shall commence at the time of substantial completion of the various portions of the system.
- B. All parts and material and their installation methods shall be in accordance with the manufacturer's recommendations and specifications. All parts and material shall be new.
- C. The Contractor or firm executing the work of this section shall have at least 10 years' experience in completing work of similar scope and nature to that specified.
- D. Provide an unconditional **TWO-YEAR** parts and service warranty. This warranty shall commence at the time of demonstration of system completion of all portions of the ATC system.
- E. Emergency response by contractor shall be available 24 hrs/day 7 days/week 365 days/yr. Response time shall not be greater than 12 hours from time of call.

1.7 SUBMITTAL AND TECHNICAL INFORMATION

- A. Submit shop drawings (6 sets) and manufacturer's data for the following items to the mechanical engineer:
 - 1. Wiring and installation diagrams.
 - 2. ATC device specification sheets
 - 3. Complete and detailed point list
 - 4. Control flow diagrams, complete with all control schematics and sequences of operation.
 - 5. Documentation of all software and hardware. These manuals shall be complete with installation procedures as well as startup and programming instructions. They should also contain any testing or maintenance procedures required to operate system on a continuing basis.

1.8 PROJECT COMPLETION REQUIREMENTS

- A. Upon completion of the project, the ATC contractor shall spend a minimum of **16 hours** with the Jordan's School District maintenance personnel to adequately instruct them on the operation and maintenance of the system. These training sessions shall be scheduled at times convenient to the
- B. School District and shall be conducted at the project. One on one, live, local hands-on training will be provided.
- C. The ATC contractor shall provide as part of his contract the on-site services of a technician familiar with the system to assist the air & water balance contractor in completing his portion of the project. The technician shall be available for a minimum of an additional **32 hours** for this assistance.
- D. The ATC contractor shall provide as part of his contract the on-site services of a programmer familiar with the system for an additional **24 hours** which the Engineer and/or the School District may use as they see fit to fine-tune or add features to the system.
- E. At 6 months after the completion date of the project, the ATC contractor will provide **16 hours** of onsite training with the owner. This training is part of this scope of work and costs shall be inclusive. The hours can be allotted in separate training sessions as determined by the owner. One on one, live, local hands-on training will be provided.
- F. At the time of the 12-month warranty walk thru the ATC contractor shall provide an additional 8 hours of training to be used as required by Jordan School District.
- G. Provide a digital copy of the project operating and maintenance instruction manuals for use during the training sessions. Each manual shall contain all system components and DDC system programming.
- H. Operation & Maintenance Manuals:
 - I. These manuals shall provide descriptions of maintenance procedures for all system components, including sensors and controlled devices. They shall cover inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components. They shall include complete as-built ATC installation drawings with sequences of operation for all mechanical systems controlled by the ATC contractor. They shall each include a complete digital copy of all as-built system programming.

PART 2 – EQUIPMENT

2.1 CONTROLLERS

- A. Provide open BACNet controls with freely programmable controllers shall be utilized as indicated and specified elsewhere in this specification. Proprietary control system communication protocols will not be accepted.
- B. All main level controller inputs shall have at least 12-bit A/D converters for input accuracy. Less resolution is unacceptable for main level controllers or any controllers using an air monitoring station or monitoring building pressure. All main level controller outputs shall have board mounted hand-off-auto switches for local output override capability.

- C. The contractor shall utilize and employ only the following controllers for any central plant systems and air handling units. A single controller shall be designated with all programming and I/O for each system. This will allow standalone equipment operation in the event of communications failure. Connection of multiple small controllers or combined operation with other programmable controllers on air handlers and central plant equipment is not permitted. All controllers shall be freely programmable; controllers with canned programming are not acceptable.
- D. All controllers and devices shall be identified.

2.2 DDC INPU DEVICES

- A. All DDC input devices shall provide industry standard signals and shall be compatible with the DDC controllers used.
- B. All temperature input devices shall have a rated accuracy of 1% or better.
- C. Temperature input devices for coils on rooftop units shall have averaging elements.
- D. All pressure input devices shall have a rated accuracy of 2% or better. Pressure transmitters shall be selected to match the application and shall not be damaged by pressures at five times the maximum measurable pressure.
- E. Miscellaneous input devices shall have accuracies as individually specified. All miscellaneous devices shall be specifically identified (with specifications) with submittals.

2.3 DDC OUTPUTS

- A. Modulating outputs shall be in accordance with industry standards and shall be compatible with the driven DDC devices.
- B. Outputs shall be 0-10 VAC/VOC or 0.5 sec - 5.0 sec. 4-20 MA, or a pneumatic signal 0-20 PSI.
- C. DDC digital outputs shall be either relay contact closures or Triacs rated for the application.

2.4 MANUFACTURERS

- A. Provide a new Direct Digital Control (DDC) system manufactured by listed manufactures for the facility mechanical equipment. The new system shall be installed, programmed and commissioned by the installing ATC contractor.

2.5 DUCT SMOKE DETECTORS

- A. Duct smoke detectors are to be furnished and wired by Division 26. Detectors shall be installed by the ATC contractor. Detectors will be provided for the return air inlet.
- B. Detectors shall be wired to allow monitoring by the DDC system as well as the fire alarm system.
- C. Division 26 shall furnish & install a fire alarm/fan shutdown relay at each fan system. The ATC contractor shall wire between the alarm relay contacts and the fan system starter to lock out the supply fans when the building is in fire alarm.
- D. Shutdown relay shall be wired to allow monitoring by the DDC System.

2.6 MOTORIZED ATC DAMPERS

- A. Motorized control dampers that are not supplied with the air handling units shall be furnished by the Automatic Temperature Control Contractor. Dampers shall be factory-built, low leakage units such as Ruskin CD-50 or approved equal. Blades shall be 6" maximum width, 6063-T5 extruded aluminum width, 1/2" axles, and Oilite or Cycloy bearings. No round shafts will be accepted.
- B. All blade-to-blade linkages shall be external and accessible. No linkage within the damper frame channel will be accepted.
- C. Frames shall be 5" x 1", 6063-T5 extruded aluminum hat channel design, 0.125" minimum thickness with corner braces to assure squareness.
- D. Dampers shall be low leakage type with compressible end seals and neoprene or extruded vinyl blade and jamb seals. Leakage shall not exceed 6.2 cfm/sq. ft. at 4" W.G. Dampers shall require less than 7#-in/sq. ft. torque at the operating shaft for proper operation.
- E. Outdoor & return air dampers shall be parallel blade with blade direction oriented to assist mixing of air streams with spring return to fail closed. Relief air and other volume control dampers shall be opposed blade.

2.7 DAMPER ACTUATORS

- A. Damper actuators shall be of the gear-train type. All moving parts shall be permanently lubricated and not require addition or replacement of oil. Actuators shall meet the NEMA 2 rating and shall have an ambient temperature operating rating of -40°F to 140°F, without the addition of extra equipment.
- B. Damper actuators shall accept the appropriate Ma, VDC or digital output signals provided by the DDC controllers.
- C. Damper actuators shall be mounted outside the air stream whenever possible and be of sufficient size to operate the connected damper. Mount damper actuator on firm baseplate.
- D. Damper actuators linked to outdoor air and relief air dampers shall close their attached dampers upon power failure or fan shutdown by means of a mechanical spring return.
- E. Actuator manufacturers shall be Belimo or Honeywell. No substitutions.

2.8 BUILDING STATIC PRESSURE CONTROL

- A. Building static pressure will be controlled by modulating open relief dampers which are located between the space and outside air. There will be a differential pressure control function which will compare inside static pressure with outside pressure and position the relief damper to maintain a .05-inch water column (adjustable) positive pressure inside with respect to outside. If building power should fail the relief damper will close (spring return). Sequencing the relief damper with the mixed air dampers will not be acceptable.

2.9 ROOM THERMOSTATS

- A. Wall-mounted space temperature thermostat. No visible readout or adjustment at thermostat. Setpoint range shall be adjustable by owner via building control system. Flat plate, stainless steel plate sensors will not be accepted.

- B. Temperature sensors in gym & cafeteria areas shall be located in return air path behind low return air grille.
- C. Thermostats shall be located on interior stud walls wherever possible.
- D. Standardized locations and mounting heights shall be predetermined with owner prior to rough-in.

2.10 ZONE TEMPERATURE SENSORS

- A. Fast response type wall mounted space temperature sensors shall be installed in wall boxes behind blank, plastic housing. Sensors shall be of a type approved by engineer and building owner. None shall be mounted on outside walls or pipe chase.

2.11 AIR QUALITY TRANSMITTERS

- A. The CO₂ sensor shall be an Alta Labs CDLSXX type, or Senya CDT1D-A3D with self-calibrating capability and local CO₂ level indication. Output signal shall be 0-5 VDC or 0-10 VDC as required by the DDC system.

2.12 PRESSURE SENSORS

- A. All wet and dry pressure sensor transducers shall include a display indicating the pressure reading on the face of the transducer.

2.13 OUTSIDE AIR SENSOR

- A. The building shall use an outside air temperature reading as obtained from government operated web sites over an internet connection for accurately controlling mechanical equipment. The ATC contractor shall provide IP level devices, hardware and any software to permit the use of the outside air temperature from the government website. A backup sensor shall be installed at the building and shall be used whenever the internet outside air temperature reading is unavailable.
- B. All outside air sensors shall be located on the north side of the building. Use of sunshields is not acceptable, unless required at north side of building.

2.14 HOST COMPUTERS & USER INTERFACE

- A. The ATC contractor will connect to the existing district user interface and provide individual user interfaces that are customized for each user type. If there is no existing district user interface, the ATC contractor shall supply and install the user interfaces as defined below and will include all software required to edit, create and modify the individual profiles. The user interface must be configured so the user type cannot see the parameters, menus, etc not included in the specific user interface as defined below. The ATC contractor shall provide the following user interface types for the JSD Learning Center. User interfaces that do not adhere the following will not be accepted.

1. USER INTERFACE FOR ALARM RESPONDER USERS.

- a. Email and SMS Text notification of alarms.

- b. Workspace that contains a Work Area pointed to a Dedicated alarm window that only shows critical alarm information for the entire school district, a graphic pointed to the district summary graphic to the right. Alarms will include:
 - 1) Low Building or Space Temperature (below 50°F at anytime)
 - 2) Main Water Flow
- c. Email and SMS Text notification of alarms. Each Notification will include the following:
 - 1) Notify on Alarm state and Reset State
 - 2) Building name in the Subject line.
 - 3) Alarm Text in the Text selection
 - 4) Monitored Value in the Text selection
 - 5) Timestamp in the Text selection
 - 6) Filtered by Categories - Temp Low Space, Temp Low Hot Water, High Freeze Cooler.
- d. Each alarm will contain a link to the main floor plan graphics page of the school that shows where the alarm originated from.
- e. Each alarm will contain a link with detailed information showing steps the alarm responder should take when responding to the alarm. A detailed step by step instruction for each alarm will be provided and configured by the ATC contractor upon approval of the steps by the District.

2. USER INTERFACE FOR CUSTODIANS.

- a. Full web-based graphics that include unit layouts and floor plans maps of the school. All temperature, status, command and control points shall be displayed on the graphics.
- b. The system tree shall be hidden
- c. All other schools within the district shall be hidden and non-accessible at the Custodian level.
- d. Alarms view on the bottom showing all alarms within the system
- e. The Software Permissions shall allow the user to override points on graphics pages.
- f. A dedicated alarm window that only shows critical alarm information for the school, the alarm filter for each building will done by alarm priority.
 - 1) Custodian Interface Alarms will include:
 - a) Low Building Temperature (below 50°F at anytime)
 - b) Fan Failures
 - c) Domestic Water Flow

- g. An event notification will be created for the school that contains the correct filtered alarms, it will be up to the individual school as to whether or not the custodian and/or principal is notified. Each Notification will include the following:
 - 1) Notify on Alarm state and Reset State
 - 2) Building name in the Subject line.
 - 3) Alarm Text in the Text selection
 - 4) Monitored Value in the Text selection
 - 5) Timestamp in the Text selection
 - 6) Filtered by priority
 - 7) Filtered by Categories - Temp Low Space, Failure Fan.
 - h. Graphic page(s) that include the ability for the custodian to override the system occupancy by entering a duration in minutes of how long the system shall run. The initial setting will be not to exceed 180 minutes (3 hours). Custodians will **not** have access to time schedules.
3. USER INTERFACE FOR ENERGY USERS.
- a. Energy and maintenance users will have access to all schools/buildings within the district. A summary page will provide basic information for each building, the information will include:
 - 1) Building Low Space Temp
 - b. Full web-based graphics that include unit layouts and floor plans maps of the school. All temperature, status, command and control points shall be displayed on the graphics.
 - c. Energy users will have access to all DDC logic pages throughout the district.
 - d. Energy users will have access to equipment runtime information and will receive equipment runtime alarms in addition to all other categorized alarms. Runtime alarms will include:
 - 1) Any fan runs longer than 13 hours per day
 - e. Email and SMS Text notification of alarms. Each Notification will include the following:
 - 1) Notify on Alarm state and Reset State
 - 2) Building name in the Subject line.
 - 3) Alarm Text in the Text selection
 - 4) Monitored Value in the Text selection
 - 5) Timestamp in the Text selection
 - 6) Filtered by Categories - Temp Low Space, Failure Fan..
 - f. Energy users will have access to the daily schedules for each building.
 - g. Energy users will have a Holiday Calendar that will provide a means for un-occupying the buildings no matter what the schedules or overrides are set to.
 - h. Energy users will have access to historical trend log data that is captured by the system.

- i. Default logs will be setup to sample every 10 minutes and keep 5000 samples available for real time reporting.
 - j. Energy users will have access to web-based reporting for historical trend log data, this can be access independently of the ATC system software.
4. USER INTERFACE FOR HVAC TECHNICIANS.
- a. Full web-based graphics that include unit layouts and floor plans maps of the school. All temperature, status, command and control points shall be displayed on the graphics.
 - b. The configuration will permit access to all graphic pages and all other buildings throughout the district. The permissions will be setup to allow the user to override points on graphics pages.
5. USER INTERFACE FOR ADMINISTRATION USERS.
- a. Full web-based graphics that include unit layouts and floor plans maps of the school. All temperature, status, command and control points shall be displayed on the graphics.
 - b. Email and SMS Text notification of alarms if requested.
- B. The School District facility management and control system includes an existing Centralized Host computer currently located at the District offices. If the control system provided for this project will not seamlessly connect to the existing centralized computer, the ATC contractor shall provide as specified to provide all programming, monitoring, alarming and configuration functions within this specification. Networking, lines, and software shall be furnished and installed by Division 25. Communication shall be completed to the Jordan's School District office by Division 25. This includes complete control system access from the District office in addition to complete control system access at the school.
- C. The most current versions of all necessary controlling & monitoring software & graphic displays shall be installed on the District Centralized Host computer. Copies of all software disks, operation manuals, along with installation instruction shall be provided to owner.
- D. All new software releases available within one year of the substantial completion date shall be provided to the owner and installed at no additional cost to the School District.
- E. The controlling software data base shall be constructed by the ATC contractor to Jordan's School District requirements. Contractor shall consult with Jordan's School District to verify these requirements as a part of this contract. Contractor shall provide a fully operational DDC control system that may be monitored, controlled & modified from the District Centralized Host computer. All control schedules, algorithms, and control logic shall be in place within each DDC controller and stored as back-up copies on both Host computers hard disks which may be downloaded to individual DDC controllers as necessary. Documentation provided shall include block software flowchart showing the interconnection between each of the control algorithms and sequences. A hard copy paper printout of points for each device shall be provided. Copies shall be provided in O&M manual and CD Rom.
- F. The building shall be represented by complete graphical floor plans, with accurate locations of each major piece of HVAC equipment. A zoom feature shall allow the operator to select any of the main fan systems and see a graphical representation of the system with dynamic representation of all appropriate DDC input & output devices. Each major piece of HVAC equipment shall be graphically represented at each Host computer with all appropriate DDC points dynamically represented.

2.15 MASTER DDC CONTROL PANEL:

- A. The master DDC control panel for the building shall be mounted in a NEMA 2 enclosure in the Main Custodian office or as directed by the owner. The ATC contractor shall furnish and install a Network/Ethernet connecting device via District supplied network lines to the District host computer.
- B. The master DDC control panel shall have a capability of overriding all HVAC unit control. Panel shall have override indicating light. Override shall be programmed for 3 hours and be interconnected to building DDC system.
- C. The master DDC controller shall have at least two RS-232 serial ports for connection to external devices. One port is to be connected to a Network/Ethernet connection, the other is to be connected directly to the local Host computer system.
- D. The master DDC controller shall be 16-bit microcomputer based, providing a multi-tasking operating system for control functions simultaneous with all other facility management, operator interface, and system communications functions.
- E. The master DDC controller shall provide true floating-point arithmetic calculations. To accommodate accumulation of large, totalized values, this controller shall support calculation and accumulation of values up to 10 to the thirty- eighth power.
- F. The master DDC controller shall provide to the Host computer diagnostic reports of the following types, for all DDC devices:
 - 1. Trend logs
 - 2. Energy reports, KW & BTUH
 - 3. Exception tables/by operator
 - 4. Override information table/by operator
 - 5. Run time information on equipment
 - 6. Review of specific facility information by operators
- G. When specified alarm conditions occur, provide a report internally listing the status of specific items associated with the equipment generating the alarm.
- H. Report shall be routed to the local Host computer, District Host computer or other combinations of computers via Network as designated by the owner. Depending on the time of day, the owner shall specify up to five sites to which exceptions shall be auto-dialed and reported. This shall allow the owner to assign off hour's exception responses to various facility personnel as necessary. Selection of the sites to be dialed can be programmed by the owner and set to change automatically per time of day and day of week. Information may be duplicated to multiple combinations of locations. Report shall record the time the status information was taken and shall allow operational personnel to use this information to diagnose the alarm situation.
- I. All programming defining the functions to be performed by the master DDC control panel from loss due to power failure for a minimum of six months.
- J. The master DDC control panel shall be multi-tasking and shall provide the capability to simultaneously perform at least, but not limited to, the following functions: Downloading of application program changes without affecting the simultaneous operation of existing operating application programming.
- K. Operator access to the entire network of local digital controllers.

2.16 LOCAL DDC CONTROL PANELS

- A. Local DDC control panels shall be located near mechanical systems as necessary to provide both digital and analog input and output points as specified and/or required to achieve specified system performance.
- B. Each local DDC control panel shall provide all control functions for the mechanical equipment specified to be controlled from that panel.
- C. Every input and output point shall be well labeled, and every digital output shall have a LED indication of the position of the output relay.
- D. ATC contractor shall provide documentation of the software application program for each digital controller.
- E. Documentation provided shall include block software flowchart showing the interconnection between each of the control algorithms and sequences. Complete ATC drawings including terminal connections shall be available at each local panel.
- F. System acceptance shall not be completed until this documentation is provided and located in each ATC interface panel.
- G. Systems providing modulating outputs via pulse width modulation techniques, shall provide within each ATC interface panel all the components required to implement the functions equivalent to an analog output.

2.17 ATC INTERFACE PANELS

- A. ATC interface panels shall be mounted near each group of local DDC controllers other than VAV box controllers. Each panel shall be made of not less than 16 gage steel. Panel shall have a full back plate and full hinged door such that when the door is closed, the assembly provides a completely enclosed, NEMA 1 enclosure. Panels shall be fully painted and fitted with key locks. Appropriately sized nameplates shall be used to identify all panel mounted devices. Major wiring within panels shall install within distribution gutters (similar to Panduit). All wiring entering and leaving panels shall terminate on numbered terminal strips. All wiring within panels shall be color coded and the color shall not be changed between the terminal strip and the end destination of that wire. Panels shall contain wiring diagrams of the panel interior and associated devices. Diagrams shall identify all interior devices and shall include terminal numbers.
- B. Panels shall contain the following devices as applicable:
 - 1. Control transformers
 - 2. NEC required fusing
 - 3. Local DDC controllers (owner requirement)
 - 4. NEC required grounding
 - 5. Logic relays
 - 6. 120 VAC convenience outlet
 - 7. Air pressure transmitters
 - 8. Control switches
 - 9. Pilot lights
 - 10. Terminal strips
 - 11. Status indicating lights

2.18 LABELING

- A. All ATC supplied panels and devices shall be permanently labeled with engraved plastic laminate labels indicating device name, system identifier and function within the system.

PART 3 – SEQUENCE OF OPERATION

3.1 PACKAGED ROOFTOP UNITS

- A. The package rooftop unit are gas fired DX cooling units with economizer and power exhaust.
- B. The controls contractor shall provide heating / cooling thermostats and wiring as required for a functioning system. The programmable thermostat shall be connected directly to the DDC control system network and communicate via a factory provided terminal strip for DDC system connection. The DDC system shall enable each RTU and provide room thermostat in each area to report the space temperature to the DDC system. A fan status point shall also be tied to the DDC system and an alarm shall be generated whenever the RTU is turned on and the fan fails to start. During occupied mode, the fan shall run continuously, and the temperature control shall be by the thermostat. The space temperature, fan status, output stages, cooling stages, discharge air temp and time scheduling shall all be shown on the DDC system. During unoccupied mode, the fan system shall
- C. The control contractor shall wire to the factory provided terminal strip.

3.2 PACKAGED AIR CONDITIONING UNIT

- A. The packaged unit is a cooling only split system.
- B. functioning system. The programmable thermostat shall be connected directly to the DDC control system network and communicate to the DDC system. The DDC system shall enable AC unit, monitor fan status, discharge air temperature and provide room thermostat in each area to report the space temperature to the DDC system. An alarm shall be generated whenever the AC unit is turned on and the fan fails to start or if the space temperature falls outside of District provided parameters. During occupied mode, the temperature control shall be by the thermostat. During unoccupied mode, the fan system shall be enabled when the temperature sensor in the space exceeds its low limit value.
- C. The control contractor shall wire the hard-wired thermostat.

3.3 AC/HEAT PUMP UNIT CONTROL

- A. Heat pump unit shall be controlled by a hard-wired wall-mounted electric type heating/cooling thermostat with dial adjustment. Unit status and room temperature shall be monitored through the Lan Network.

3.4 MDF/IDF/ELECTRICAL ROOM COOLING CONTROL

- A. AC/Heating split system unit shall be controlled by a hard-wired wall-mounted electric type heating/cooling thermostat with dial adjustment. Unit status and room temperature shall be monitored through the Lan Network.
- B. Room shall be on District temperature alarm.

3.5 GAS FIRED UNIT HEATER CONTROL

- A. A room temperature sensor, acting through a DDC controller, shall cycle the gas fired unit heater to maintain desired room space temperature.

3.6 ELECTRIC UNIT HEATER CONTROL

- A. A wall-mounted line voltage thermostat shall control the unit heater and fan to maintain space temperature setpoint with a room thermostat reading to the BMS.

3.7 FIRE ALARM FAN SHUT-DOWN: (All Fan Systems)

- A. All heating, ventilating and air conditioning system supply fans shall automatically shut off when the building fire alarm system is energized. All fans to automatically start up again when fire alarm system is reset. Fire alarm system fan relays shall be "normally energized" and shall be installed by Division 26 at each fan system.

3.8 FAN SYSTEM FILTER BANK ALARMS

- A. A differential pressure indication control element with its static pressure tips located across each fan system filter bank & makeup air unit filter bank shall provide the DDC system with the differential pressure drop across each filter bank. An alarm shall be supplied to the DDC system whenever the filter differential pressure remains above 0.35" w.c. for more than 15 continuous minutes.

3.9 TOILET ROOM EXHAUST FANS

- A. Roof mounted; toilet room exhaust fans shall be individually operated by pre-determined schedules from the building DDC system. Fan status shall be monitored, and an alarm sent to District personnel if the status does not meet the command.
- B. Ceiling type, toilet room exhaust fans shall be individually operated by the occupancy sensor/ or lighting control with a 10 min. (adj) delay. Fan status shall be monitored, and an alarm sent to District personnel if the status does not meet the command.

3.10 JANITORS ROOM EXHAUST FAN CONTROL

- A. Each janitor's room exhaust fan shall be individually operated by the occupancy sensor/ or lighting control with a 10 min. (adj) delay. Fan status shall be monitored, and an alarm sent to District personnel if the status does not meet the command.

3.11 DOMESTIC HOT WATER SYSTEMS

- A. There are two domestic hot water heating systems; (1) 120°F. System consist of a hot water heater, and recirculation pump.
- B. When the building is in OCCUPIED mode, the main 120°F system hot water heater and its recirculation pump shall be enabled & the recirculating pump shall run based on return water temperature from a pipe mounted aquastat. When the building is in UNOCCUPIED mode, the hot water heater and the recirculating pump shall remain off and unoccupied water temperature to be determined by water heater tank water temperature and pipe mounted aquastat.
- C. Once enabled by the DDC system, the domestic hot water heaters shall operate under their factory supplied controls.

3.12 EXHAUST FAN

- A. The Faculty Room exhaust fans shall be controlled by a wall switch with 0-2-hour timer with indicating light furnished and installed by the ATC contractor. Fan status shall be monitored, and an alarm sent to District personnel if the status does not meet the command.
- B. The Science/Art/CTE Room exhaust fan shall be controlled by a wall switch with 0-2-hour timer with indicating light furnished and installed by the ATC contractor. Fan status shall be monitored, and an alarm sent to District personnel if the status does not meet the command.

3.13 DOMESTIC WATER FLOW SECURITY SENSOR

- A. A paddle type, water flow sensor located in the smaller of the two lines in the main domestic water line and upstream from the pressure reducing valve, Alarm shall be generated to the District security system any time flow is sensed during the UNOCCUPIED mode. Division 25 contractor shall run line to building security dam for tie into building security system. The flow switch shall be furnished and wired by the ATC contractor and installed by the plumbing contractor. ATC contractor to coordinate size required. Provide status contact closure to the security system. Coordinate line to security panel with Division 26.
- B. Saddle type flow switch is not allowed

3.14 FIRE RISER ROOM SPACE TEMPERATURE ALARM

- A. Provide an analog DDC temperature sensor for the fire riser room. Coordinate alarm to the District remote security facility with Division 26. Alarm shall be generated to the District security whenever temperatures **drop below** the owner determined limits via a status contact closure to the security system. Division 25 contractor shall run line to building security dam for tie into building security system. System must be configured to follow the alarm requirements defined within this specification. Coordinate line to security panel with Division 26.

3.15 AREA SECURITY TEMPERATURE ALARMS

- A. Temperature sensors located in an area served by each fan system shall continuously monitor the space temperature and alarm the District security system anytime the space temperature drops below or rises above preset set points. Division 25 contractor shall run line to building security dam for tie into building security system.
- B. Upon receiving an alarm from the District security system, the Host computer at the school and at the District Offices shall indicate which area(s) of the building are in alarm through a graphic floor plan display of the building(s). Current space temperatures shall also be displayed at the Host computer.
- C. Division 25 contractor shall run line to building security dam for tie into building security system. Provide status contact closure to the security system. Coordinate line to security panel with Division 26.
- D. It is the intent that Division 251000 provide all wiring, etc. as required to tie listed systems into the JSD security alarm system in partner with Division 260000.

3.16 LIGHTING CONTROL

- A. Division 251000 contractor shall provide all wiring as required to tie-in DDC system to master lighting relay panel located in the Main Electrical Room. Through a BacNet interface. Refer to the

electrical lighting detail plans for information on lighting control and Division 260943 of the specifications, "LIGHTING CONTROL EQUIPMENT".

3.17 POWER MONITORING

- A. Division 26 and Rocky Mountain Power will furnish & install electrical power meters with pulse type output wired for integration into the DDC system. ATC contractor shall provide all wiring, conduit, programming and all controllers for monitoring of meters for continuous power consumption.

3.18 HOST COMPUTER & BUILDING GRAPHIC DISPLAY

- A. Graphics pages shall be created to remain consistent with the existing graphics on the districts host computer. Floor plans, air handler summaries, and alarm pages, equipment pages, summary pages, etc. shall all be included. In addition to this section, the ATC contractor shall refer to section 2.13 and other sections within this specification for user interface, alarming, programming and configuration requirements from the graphical user interface (Host Computer).
- B. User views shall be configured and display the specified information as defined by section 2.13 and this section.
- C. The building shall be represented by complete graphical floor plans, with accurate locations of each major piece of HVAC equipment. Each piece of HVAC equipment shall be graphically represented at each Host computer with all appropriate DDC points dynamically represented. The ATC contractor shall supply and install any and all software required, and leave with the owner, that permits full capabilities including programming, graphic page alterations, creations, system additions, modifications, controller additions, alarm configuration, alarm notification, trending, scheduling and permit full access to all features, set up and configuration of the DDC control system in its entirety.
- D. Table view or spread sheet style graphics shall be included for air handlers:
 - 1. The table view graphics page shall summarize the air handlers in the building by looking at a single graphics page.
 - 2. Summarized information for each air handler shall include:
 - a. Air Handler / RTU number
 - b. Occupancy state
 - c. Fan Status
 - d. % Heating or Cooling load of the Air Handler
 - e. High Space Temp
 - f. Low Space Temp
 - g. Duct Static Pressure
 - h. Discharge Temperature
 - i. Total Daily Runtime (resets at midnight)
 - j. Optimum Start Runtime (shows daily start time required)
 - 3. The above data will be used for continuous commissioning purposes and energy management.
- E. All graphics of air handlers, chillers, and boiler systems shall include daily equipment runtime values that reset each midnight.

- F. Runtimes of all air handlers, rooftops relief fans, exhaust fans, boilers, chillers, and equipment pumps shall be logged at the host computer. The ATC contractor shall provide runtime reports to enable monitoring of the building performance.

- G. Table view or spread sheet style graphics shall be included for all VAV boxes:
 - 1. The table view graphics page shall summarize the VAV boxes in the building by summarizing VAV boxes for each particular air handler on a single graphics page.

 - 2. Summarized information for each air handler shall include:
 - a. Room Number
 - b. Occupancy state
 - c. KBTU
 - d. KBTU per square foot
 - e. Space Temp
 - f. Space Set point
 - g. CFM Set point
 - h. CFM Flow
 - i. Discharge Temperature
 - j. Total Daily Runtime (resets at midnight)
 - k. Optimum Start Runtime (shows daily start time required)

 - 3. The above data will be used for continuous commissioning purposes and energy management.

BUILDING DDC SYSTEM INPUT/OUTPUT POINT SUMMARY:

The ATC contractor shall furnish and install all DDC controllers, sensors, interface relays, wiring and other field accessories for the DDC system to provide for implementation of the above sequences of operation and including the input-output points listed below. All points shall be displayed on password-protected graphic screens on both the existing District host computer and the man-machine interface or Host computer located in the Main Custodial office.

DIGITAL OUTPUTS:

LIGHTING CONTROL	ON/OFF
SUPPLY FAN VFD (each VFD)	START-STOP
RETURN/RELIEF FAN (each VFD)	START-STOP
MAIN HEATING PUMPS (each pump)	START-STOP
110° F CULINARY SYSTEM	ENABLE-DISABLE
HEATING UNITS (each heater)	ENABLE-DISABLE
TOILET ROOMS EXHAUST FANS (each fan)	START-STOP
PACKAGED ROOFTOP UNITS	START-STOP
FUTURE USE BY OWNER (6 outputs)	

DIGITAL INPUTS:

DOMESTIC WATER FLOW SECURITY SENSOR	STATUS
BUILDING FIRE ALARM SYSTEM	STATUS
SMOKE DETECTORS (each individual detector)	STATUS
LOW LIMIT THERMOSTAT	STATUS
SUPPLY DUCT HIGH STATIC	STATUS
OVERRIDE TIMERS	STATUS
FUTURE USE BY OWNER (4 inputs)	

ANALOG INPUTS:

CULINARY 120° F STORAGE TANK	TEMP
SUPPLY AIR (EACH ROOFTOP)	TEMP
FAN SYSTEM SPACE	TEMP
UNITARY HEATERS	SPACE TEMP
MIXED AIR (EACH ROOFTOP UNIT)	TEMP
RETURN AIR (EACH ROOFTOP UNIT)	TEMP
FAN SYSTEM CO2 SENSORS (EACH ROOFTOP UNIT)	PPM
BUILDING STATIC	PRESS
SUPPLY DUCT STATIC (EACH ROOFTOP)	PRESS
FUTURE USE BY OWNER (4 INPUTS)	

ANALOG OUTPUTS:

FAN SYSTEM OA & RA DAMPERS	0-10 VDC OR PWM
BUILDING RELIEF DAMPERS	0-10 VDC OR PWM
SUPPLY FAN SPEED	0-10 VDC OR PWM
FUTURE USE BY OWNER (4 OUTPUTS)	0-10 VDC OR PWM

END OF SECTION

JORDAN SCHOOL DISTRICT (JSD) HAS PREVIOUSLY PROCURED THE CT/MS, MDP, AND LDP SWITCHGEAR. DIVISION 26 SHALL INCLUDE WITHIN THEIR BID PACKAGE THE RECEIVING AND INSTALLATION OF THE PREVIOUSLY PROCURED CT/MS, MDP AND LDP ALONG WITH THE ENTIRETY OF THE REMAINING GEAR, EQUIPMENT, FEEDERS, AND THE COMPREHENSIVE INSTALLATION OF THE ENTIRE ONE-LINE AND ELECTRICAL INFRASTRUCTURE WITHIN THEIR BID. DIVISION 26 WILL SHOULD THE RESPONSIBILITY OF BOTH RECEIVING THE ITEMS AND ENSURING THE COMPLETE INSTALLATION OF THE ELECTRICAL SYSTEM, ALONG WITH ALL OTHER NECESSARY PREREQUISITES TO ESTABLISH A FULLY FUNCTIONAL ELECTRICAL SYSTEM. COORDINATE WITH CODALE ELECTRICAL SUPPLY AS REQUIRED.

SECTION 26 0500 - ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Architectural, Structural, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full. Contractor must review the entire set of plans and specifications. Reviewing only the electrical set is not acceptable.

1.2 DESCRIPTION OF WORK:

- A. The extent of electrical work is indicated on drawings and/or specified in Divisions 26, 27 and 28 sections of the specification. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system. Work includes, but is not necessarily limited to, the following items.

	<u>ITEM</u>	<u>SECTION</u>
1.	Electrical General Provisions	26 0500
2.	Mechanical and Electrical Coordination	26 0501
3.	Electrical Submittals O&M Manuals and Spare Parts	26 0502
4.	Electrical Connections for Equipment	26 0507
5.	Conductors and Cables	26 0519
6.	Grounding	26 0526
7.	Supporting Devices	26 0529
8.	Conduit Raceway	26 0532
9.	Electrical Boxes and Fittings	26 0533
10.	Raceway Systems	26 0536
11.	Electrical Seismic Control	26 0548
12.	Electrical Identification	26 0553
13.	Protective Device Study	26 0573
14.	Occupancy Sensors	26 0923
15.	Lighting Control Equipment	26 0943
16.	Energy & Power Metering System	26 1010
17.	Transformers	26 2200
18.	Switchgear and Switchboards	26 2413
19.	Panelboards	26 2416

20.	Service Entrance	26 2713
21.	Wiring Devices	26 2726
22.	Overcurrent Protective Devices	26 2815
23.	Motor and Circuit Disconnects	26 2816
24.	Motor Starters	26 2913
25.	Emergency Electrical Systems	26 3213
26.	Power Factor Correction	26 3533
27.	Demolition	26 4119
28.	Surge Protective Devices (SPD)	26 4313
29.	Interior and Exterior Building Lighting	26 5100
30.	Exterior Area Lighting	26 5600
31.	System Commissioning	26 9000
32.	Telephone/Data Systems	27 1500
33.	Audiovisual Systems	27 4100
34.	Audiovisual Systems Checklist	27 4101
35.	Intercommunications System	27 5123
36.	Common requirements for intrusion, Access & Video Surveillance	28 0501
37.	Intrusion Detection System	28 1600
38.	Access Control System	28 2205
39.	Video Surveillance System	28 2301
40.	Fire Alarm and Detection System	28 3111

- B. Use of standard industry symbols together with the special symbols, notes, and instructions indicated on the drawings describe the work, materials, apparatus and systems required as a portion of this work.
- C. Visit the site during the bidding period to determine existing conditions affecting electrical and other work. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

1.3 DEFINITION OF TERMS

- A. The following terms used in Divisions 26, 27 and 28 documents are defined as follows:
 - 1. "Provide": Means furnish, install and connect, unless otherwise indicated.
 - 2. "Furnish": Means purchase and deliver to project site.
 - 3. "Install": Means to physically install the items in-place.
 - 4. "Connect": Means make final electrical connections for a complete operating piece of equipment.

1.4 RELATED SECTIONS:

- A. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
- B. General and Supplementary Conditions: Drawings and general provisions of contract and Division 1 of the Specifications, apply to all Division 26, 27 and 28 sections.
- C. Earthwork:
 - 1. Provide trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, buried cable, in-grade pull boxes, manholes,

lighting pole foundations, etc. See Division 31, Sitework, and other portions of Divisions 26, 27 and 28, for material and installation requirements.

- D. Concrete Work:
 - 1. Provide forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting as required for underground conduit encasement, light pole foundations, pull box slabs, vaults, equipment pads, etc. See Division 3, Concrete for material and installation requirements.
- E. Miscellaneous Metal Work:
 - 1. Provide fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution boards, switchboards, motor controls centers, etc. See Division 5, Metals for material and installation requirements.
- F. Miscellaneous Lumber and Framing Work:
 - 1. Provide wood grounds, nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment. See Division 6, Rough Carpentry for material and installation requirements.
- G. Moisture Protection:
 - 1. Provide membrane clamps, sheet metal flashing, counter flashing, caulking and sealants as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors and ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight. See Division 7, Thermal and Moisture Protection for material and installation requirements.
- H. Access panels and doors:
 - 1. Provide in walls, ceiling, and floors for access to electrical devices and equipment. See Division 8, Doors and Windows for material and installation requirements.
- I. Painting:
 - 1. Provide surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, poles, surface metal raceways, etc. See Division 9, Finishes for material and installation requirements.

1.5 WORK FURNISHED AND INSTALLED UNDER ANOTHER SECTION REQUIRING CONNECTIONS UNDER THIS SECTION:

- A. Provide electrical service, make requisite connections and perform operational test. Items furnished and installed under other sections and connected under this section, include but are not limited to the following:
 - 1. Electric motors.
 - 2. Package mechanical equipment: fans, fan coil units, pumps, boilers, duplex compressors, etc.
 - 3. Flow switches and valve monitors.
 - 4. Motorized dampers.
 - 5. Fire and smoke dampers
 - 6. Duct mounted smoke detectors.
 - 7. Irrigation controllers.
 - 8. Door hold-open/release devices.
 - 9. Motorized projection screens.

10. Wheel chair lifts.
11. Roll down doors.
12. Electric hardware.
13. Laboratory equipment including hoods, cold rooms, autoclaves, drying ovens, glassware washers and dryers, refrigerators, freezers, etc.
14. Shop equipment including saw dust collectors, saws, lathes, grinders, welders, planers, presses, etc.
15. Temperature control panels.
16. Variable frequency controllers.
17. Chiller starters.
18. Motorized Chalkboards/Markerboards/Whiteboards.
19. Display cases.
20. Water coolers.
21. Kitchen equipment including ovens, fryers, mixers, disposers, dishwashers, etc.
22. Fire sprinkler alarm bells.
23. Electric heat trace cable for domestic and industrial hot water piping systems.
24. Electric heat trace cable for guttering, drain lines, etc.
25. Anti-sweat heaters, fan coils, etc. for walk-in coolers and freezers.
26. Hand dryers, hair dryers.
27. Systems/Open Office Furniture

1.6 ITEMS FURNISHED UNDER ANOTHER DIVISION, BUT INSTALLED AND CONNECTED UNDER THIS DIVISION:

- A. Items furnished under other Divisions, but turned over to Division 26 for installation and final connection include, but are not necessarily limited to, the following:
1. Wall mounted control stations for motorized roll-up doors/grills.
 2. Wall mounted control stations for motorized projection screens.
 3. Wall mounted control stations for handicap lift.
 4. Lighting fixtures for paint spray booths.
 5. Lighting fixtures for walk-in freezers and coolers.
 6. Audio Enhancement/Lightspeed System components and teaching space cameras are supplied by Owner and installed by Division 26 and 27 contractor.

1.7 WORK NOT INCLUDED IN THIS DIVISION:

- A. Items of work provided under another contract include, but are not necessarily limited to, the following:
1. Communications/Data electronic equipment.
 2. Control wires for irrigation control valves.
 3. Energy management/temperature control system; both line and low voltage including conductors and conduit.
 4. Television monitors and projection equipment.
 5. Security system equipment.
 6. CCTV electronic equipment.
 7. MATV electronic equipment

1.8 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS:

- A. Before bidding, Contractor shall familiarize himself with the drawings, specifications and project site. Submit requests for clarification to Architect/Engineer in writing prior to issuance of final addendum. After signing the contract, the Contractor shall meet the intent, purpose, and function of the Contract Documents. Any costs of materials, labor and equipment arising therefrom, to make each system complete and operable, is the responsibility of the Contractor.

1.9 QUALITY ASSURANCE:

- A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refers to the latest edition of such publications adopted and published prior to submittal of the bid proposed, unless noted otherwise herein. Such codes or standards are considered a part of this specification as though fully repeated herein.
- B. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred as reducing the quality, requirements or extent of the Drawings and Specifications. Perform work in accordance with applicable requirements of all governing codes, rules and regulations including the following minimum standards, whether statutory or not:
 - 1. National Electric Code (NEC).
 - 2. International Building Code (IBC).
 - 3. International Fire Code (IFC).
 - 4. International Mechanical Code (IMC).
- C. Standards: Comply with the following standards where applicable for equipment and materials specified under this Division.
 - 1. UL Underwriters' Laboratories
 - 2. ASTM American Society for Testing Materials
 - 3. CBN Certified Ballast Manufacturers
 - 4. IPCEA Insulated Power Cable Engineers Association
 - 5. NEMA National Electrical Manufacturer's Association
 - 6. ANSI American National Standards Institute
 - 7. ETL Electrical Testing Laboratories
- D. All electrical apparatus furnished under this Section shall conform to (NEMA) standards and the NEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.
- E. Comply with requirements of State and Local Ordinances. If a conflict occurs between these requirements and the Contract Documents, the most stringent requirements shall govern. The Contractor accepts this responsibility upon submitting his bid, and no extra charge will be allowed after the contract is awarded. This shall not be construed as relieving the Contractor from complying with any requirements of the Contract Documents that may be in excess of the aforementioned requirements, and not contrary to same.
- F. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Furnish a certificate of approval to the Owner's Representative from the Inspection Authority at completion of the work.
- G. Employ only qualified craftsmen with at least three years of experience. Workmanship shall be neat, have a good mechanical appearance and conform to best electrical construction practices. Provide a competent superintendent to direct the work at all times.

Any person found incompetent shall be discharged from the project and replaced by satisfactory personnel.

- H. Contractor shall have a current state contracting license applicable to type of work to be performed under this contract.
- I. A full-time competent Project Foreman shall be designated by the contractor to the Owner's Representative and shall be available, on site, for consultation to direct the work at all times. This individual, when appointed, will not be replaced without prior approval from the Owner's Representative. The Foreman shall be responsible for coordination and correct placing of the of work included in Divisions 26, 27 and 28.
- J. Required Pre-Electrical Construction Meeting with Electrical Engineer: Electrical contractor/representative will be required to attend a pre-electrical construction meeting (approximately 30-60 minutes) with engineering representative in the electrical engineers office prior to electrical construction commencement. This meeting will address any questions on the part of the contractor and the expectations of the Engineer with regard to specifications, plans and site visits for both rough and finish electrical work.

1.10 CONSTRUCTION CHANGE ORDER PROPOSALS

- A. In the event that a submission of a change order is issued by the contractor, the following information will be required to be submitted by the contractor, prior to any consideration by the owner/architect.
 - a. Where project manager or project engineer work is required, the labor cost shall not exceed 2% of the electrical portion of the change order.
 - b. All equipment, including conduit and wire, shall be itemized, identifying unit costs and quantities of equipment. Distributor quotes shall accompany all change order requests. The distributor quotes shall include costs for all equipment including conduit and wire. Lot pricing for equipment is not acceptable.
 - c. The general contractor shall review and confirm that the quantity and costs of materials submitted appear reasonable for the scope proposed.
 - d. Labor units shall not exceed base NECA #1 standards. No adjustment factors shall be approved.
 - e. Any research and labeling time, shall be the responsibility of the electrical contractor and shall not be included in the change order request.
 - f. Any costs associated with the purchase of tools or transportation shall be fully itemized for review by architect/owner.
 - g. Overtime rates shall only be approved where additional manpower cannot achieve the same result.
 - h. Change order form shall follow the following format:
 - i. PCO number
 - ii. Detailed description of work being performed
 - iii. Location on project where work is performed
 - iv. Chosen NECA column
 - v. Identified material:
 - 1. QTY
 - 2. Unit cost
 - 3. Mark up
 - 4. Material total
 - vi. Identified labor:
 - 1. QTY
 - 2. Unit cost
 - 3. Composite labor rate
 - 4. Labor total

1.11 SUBMITTALS: Refer to Section 26 0502 for requirements.

1.12 RECORD DRAWINGS:

- A. Maintain, on a daily basis, a complete set of "Record Drawings", reflecting an accurate record of work in accordance with the following:
1. Show the complete routing and location of all feeders rated 100 amps and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.)
 2. Show the complete routing and location of all telecommunications conduits, systems raceways, and empty raceways, 1-1/4" and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.).
 3. Show all changes, deviations, addendum items, change orders, job instructions, etc., that change the work from that shown on the contract documents, including wall relocations, fixtures and device changes, branch circuiting changes, etc. Where locations of boxes, raceways, equipment, etc. are adjusted in the field to fit conditions, but such new locations may not be obvious by referring to the contract document, show new locations on the record drawings.
- B. At the discretion of the Architect/Engineer, the drawings will be reviewed on a periodic basis and used as a pre-requisite for progress payments. This requirement shall not be construed as authorization for the Contractor to make changes in the layout, or work without written authorization for such changes. The "Record Drawings" for daily recording shall consist of a set of blue line prints of the Contract Drawings.
- C. Upon completion of the work, purchase a complete set of electronic drawings. Transfer all "Record" information from the blue line prints to the drawings via the current CAD program that it was written. The Architect/Engineer shall review the drawings and the Contractor shall incorporate the resulting comments into the final record drawings. The Contractor shall make two complete copies of the drawings electronically and forward this to the Engineer.
- D. Certify the "Record Drawings" for correctness by placing and signing the following certifications of the first sheet of the drawings:

"CERTIFIED CORRECT (3/8" high letters)

(Name of General Contractor)

By: _____ Date: _____

(Name of Electrical Contractor)

By: _____ Date: _____

1.13 GUARANTEE:

- A. Ensure that electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes. Without additional charge, replace any work or materials that develop defect, except from ordinary wear and tear, within one year from the date of substantial completion.

Exception: Incandescent and fluorescent lamps shall be guaranteed for a period of two months from the date of substantial completion.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Products are specified by manufacturer name, description, and/or catalog number. Discrepancies between equipment specified and the intended function of equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Architect/Engineer who will issue interpretation and/or additional instructions to Bidders before the project is bid.

2.2 MANUFACTURERS:

- A. Provide products of manufacturers specified. Manufacturers catalog numbers and descriptions establish the quality of product required. Substitutions will be considered if a duplicate written application (2-copies) is at the office of the Architect/Engineer eight (8) working days prior to the day of the bidding. The application shall include the following: 1) A statement certifying that the equipment proposed is equal to that specified; that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents; 2) The specified and submittal catalog numbers of the equipment under consideration; 3) A pictorial and specification brochure.
- B. Any conflict arising from the use of substituted equipment shall be the responsibility of the Contractor, who shall bear all costs required to make the equipment comply with the intent of the contract documents.
- C. Samples may be required for non-standard or substituted items before installation during construction. Provide all samples as required.
- D. No materials or apparatus may be substituted after the bid opening except where the equipment specified has been discontinued.
- E. Provide only equipment specified in the Contract Documents or approved by addendum.

2.3 SPARE PARTS:

- A. Provide spare parts (fuses, diffusers, lamps, etc.) as specified. Transmit all spare parts to Owner's Representative prior to substantial completion.

PART 3 – EXECUTION

3.1 INSTALLATION:

- A. Layout electrical work in advance of construction to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary for proper installation; perform with care. Use skilled mechanics of the trades involved. Repair damage to building and equipment at no additional cost to the contract. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting structural members shall not be permitted.
- B. Provide equipment enclosures appropriate to the environment to which they are installed. For example, provide NEMA 3R for exterior enclosures and NEMA 1 for interior enclosures unless otherwise noted.

- C. Since the drawings of floor, wall, and ceiling installation are made at small scale; outlets, devices, equipment, etc., are indicated only in their approximate location unless dimensioned. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned, and coordinate such locations with work of other trades to prevent interferences. Verify all dimensions on the job. Do not scale the electrical drawings, but refer to the architectural and mechanical shop drawings and project drawings for dimensions as applicable.
- D. Perform for other trades, the electrical wiring and connection for all devices, equipment or apparatus. Consult Architectural, Mechanical, and other applicable drawings, and all applicable shop drawings to avoid switches, outlets, and other equipment from being hidden behind doors, cabinets, counters, heating equipment, etc., or from being located in chalkboards, tackboards, glass panels, etc. Relocate buried electrical devices and/or connections as directed at no additional cost.
- E. Coordinate the location of outlets, devices, connections, and equipment with the supplier of the systems furniture prior to rough-in.
- F. Where conduit, outlets or apparatus are to be encased in concrete, it must be located and secured by a journeyman or foreman present at the point of installation. Check locations of the electrical items before and after concrete and/or masonry installation and relocate displaced items.
- G. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.

3.2 CLEAN:

- A. Clean up all equipment, conduit, fittings, packing cartons and other debris that is a direct result of the installation of the work of this Division.
- B. Clean fixtures, interiors and exteriors of all equipment, and raceways. Replace all filters in electrical equipment upon request for Substantial Completion.

3.3 POWER OUTAGES:

- A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the Owner. Include all costs for overtime work in bid.
- B. Submit written request at least 7 days in advance of scheduled outage and proceed with outage only after receiving authorization from the Owner's Representative.
- C. Keep all outages to an absolute minimum.

3.4 STORAGE AND PROTECTION OF MATERIALS:

- A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. In no case shall storage interfere with traffic conditions in any public thoroughfare or constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.5 EXCAVATING FOR ELECTRICAL WORK:

- A. General: Locate and protect existing utilities and other underground work in manner that will ensure that no damage or service interruption will result from excavating and backfilling. Perform excavation in a manner that protects walls, footings, and other structural members from being disturbed or damaged in any way. Burial depths must comply with NEC Section 300-5 (or State of Utah requirement, whichever is more

stringent), unless noted otherwise on drawings.

- B. Coordinate all requirements for excavation for street lighting poles with South Jordan City. Verify all requirements city excavation requirements.
- C. Protect persons from injury at excavations, by barricades, warnings and illumination.
- D. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.
- E. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install electrical work on frozen excavation bases or sub-bases.
- F. Do not excavate for electrical work until the work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum. See other sections of specification for additional requirements for excavating.
- G. Store excavated material (temporarily) near excavation, in a manner that will not interfere with or damage excavation or other work. Do not store under trees (within drip line).
- H. Retain excavated material that complies with requirements for backfill material. Dispose of excavated material that is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material. Remove unused material from project site, and dispose of in lawful manner.

3.6 BACKFILL MATERIALS:

- A. For buried conduit or cable (other than below slab-on-grade, or concrete encased) - 2" thickness of well graded sand on all side of conduit or cable.
- B. For trench backfill to within 6" of final grade - soil material suitable for compacting to required densities.
- C. For top 6" of excavation - Top soil.
- D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment.
 - 1. Lawn/Landscaped Areas: 85 percent for cohesive soils, 95 percent for cohesionless soils.
 - 2. Paved Areas, Other than Roadways (90 percent for cohesive soils, 95 percent for cohesionless soils).
- E. Subsidence: Where subsidence is measurable or observable at electrical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality and condition of the surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.7 UTILITY COORDINATION:

- A. Coordinate closely with Rocky Mountain Power (RMP) to finalize the conduit routing shown on the site plan. Verify all equipment dimensions and locations before beginning rough in. verify location of transformers for service to the building, as well as service to street lights. Consult all applicable contract drawings and RMP ESR (latest edition) to insure RMP code clearances required around all electrical equipment, trenching and burial depths, and identification requirements are met. Adjust locations of electrical work, boxes, outlets etc. As necessary to avoid obstructing electrical equipment or building appurtenances. Where job conditions require changes from the contract documents that do not change the scope of installation or nature of work required, the contractor will

make such changes without additional cost to the owner. No other changes may be made without written permission of the owner.

3.8 CONCRETE BASES:

- A. Unless otherwise noted, provide 4" high reinforced concrete bases for all floor mounted or floor standing electrical equipment, including generators, transformers, switchgear, battery racks, motor control centers, etc. Extend bases 6" beyond equipment or mounting rails on all sides or as shown on the drawings. Notwithstanding this requirement, coordinate with equipment manufacturer, shop drawings, and height of base to ensure compliance with NEC 404.8.
- B. Concrete bases, curbs, trenches, housekeeping pads, pedestals, etc., including utility transformer, distribution switchgear, pole bases, etc. shall be provided under Division 26 and comply with Division 3 requirements. Coordinate size and location of all bases with all required anchor bolts, sleeves, reinforcing and templates as required to obtain a proper installation.
- C. Provide and locate properly sized concrete pads for power company furnished pad mounted transformers in accordance with power company clearance requirements. Where the serving utility is Rocky Mountain Power, the electrical contractor shall conform to the requirements of Electrical Service Requirements, Section 6.4.

3.9 ROOF PENETRATIONS:

- A. Where raceways penetrate roofing or similar structural area, provide appropriate roof jack coordinate with the roofing contractor and the Architect in order to match the vent with the roof construction. The jack shall be sized to fit tightly to raceway for weather-tight seal, and with flange extending a minimum of 9" under roofing in all sides or as required by the roof type of construction. Completely seal opening between inside diameter of roof flashing and outside diameter of penetrating raceways. Coordinate all work with work required under roofing section of specifications.

3.10 FIRE PENETRATION SEALS:

- A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. The fire rating of the penetration seal shall be at least that of the floor, wall or ceiling that it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs, and similar structures. Where applicable, provide [3M](#) CID cast-in device for floor slabs. Where applicable, provide [3M](#) fire barrier sealing penetration system, and/or IPC Flame Safe Fire Stop System, and/or Chase Foam fire stop system, including wall wrap, partitions, caps, and other accessories as required. All materials to comply with UL 1479 (ASTM E-814). Comply with manufacturer's instructions and recommendations for installation of sealing fittings and barrier sealing systems.

3.11 PROJECT FINALIZATION AND START-UP:

- A. Upon completion of equipment and system installation, assemble all equipment Factory Representatives and Subcontractors for system start-up.
- B. Each Representative and Subcontractor shall assist in start-up and check out their respective system and remain at the site until the total system operation is accepted by the Owner's representative.
- C. The Factory Representative and/or System Subcontractor shall give personal instruction

on operating and maintenance of their equipment to the Owner's maintenance and/or operation personnel. To certify acceptance of operation and instruction by the Owner's Representative, the contractor shall prepare a written statement as follows:

1. This is to certify that the Factory Representative and System Subcontractor for each of the systems listed below have performed start-up and final check out of their respective systems.
2. The Owner's Representative has received complete and thorough instruction in the operation and maintenance of each system.

SYSTEM	FACTORY REPRESENTATIVE
(List systems included)	(List name and address of Factory Representative)

Owner's Representative

Contractor

- D. Send copy of acceptance to Architect/Engineer.

3.12 FINAL REVIEW:

- A. At the time of final review, the project foreman shall accompany the reviewing party, and remove coverplates, panel covers and other access panels as requested, to allow review of the entire electrical system.

END OF SECTION 26 0500

SECTION 26 0501 - MECHANICAL / ELECTRICAL & OWNER PROVIDED EQUIPMENT
COORDINATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Architectural, Structural, Vertical Transportation, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full. Contractor must review the entire set of plans and specifications. Reviewing only the electrical set is not acceptable.

1.2 CONTRACTOR RESPONSIBILITIES

- A. Electrical Contractor shall verify electrical service provided prior to ordering any electrical equipment serving owner-provided equipment / mechanical equipment, and Electrical Contractor shall have the final responsibility for properly coordinating the electrical work, including the exact location, quantity and sizes of the electrical connection(s).
 - 1. Circuit breakers, disconnects, starters, fuses, conduit sizes, wire sizes, VFDs, etc. have been coordinated by Engineers and sized according to the mechanical systems "Basis of Design". Coordinate with Division 23 Contractor for any changes arising from substituted equipment or changes to the basis of design in any way. Coordinate all requirements of multi-motor VFD control (including fanwall units) and ensure all provisions accordingly. Prepare documentation showing changes in the electrical characteristics of each piece of equipment that has changed and submit for acceptance. All costs arising from said changes shall be the responsibility of Division 23.
- B. The Division 26 contractor (electrical contractor) shall provide and install all conduit and wall boxes to temperature sensors, thermostats, ATC wall boxes, and wall mounted control panels. Conduit shall be minimum 3/4" and run from above the ceiling elevation to the box. Where there are no ceiling, conduit shall run from above the bottom of structure to the box.
- C. Division-26 is responsible to provide conduit and rough-in for all thermostat controls located within walls. Refer to division 21-23 drawings and coordinate with controls contractor to verify exact location of all thermostats. Provide electrical boxes, metal conduit, tubing, and fittings of types, grades, sizes, and weights (wall thickness) as indicated; with minimum trade size of 3/4". Surface mounted raceway in finish areas is not allowed.
- D. Electrical contractor shall verify all conduit and rough-in requirements prior to any rough-in of thermostat pathways, and electrical contractor shall have the final responsibility for properly coordinating the electrical work, including the exact location of the thermostats. Obtain submittals of all wall mounted thermostats from controls contractor and division 21 through 23 contractor(s).
- E. Notify engineer of any modifications between contract documents and submittals. It shall be the contractor's responsibility to ensure compliance with the documents.
- F. The electrical contractor shall be responsible for coordinating all their own block outs and coordinating their space of a shared block out.
- G. Coordinate all interfaces between mechanical/temperature controls and

electrical/communications/security divisions before submitting any equipment for review or beginning installation.

- H. Obtain submittals of all mechanical equipment from Division 21 through 25 contractor(s) as they are submitted to the design team.
 - 1. Notify engineer of any modifications between contract documents and submittals. It shall be the contractor’s responsibility to ensure compliance with the documents.
- I. Electrical contractor shall be responsible for coordinating all their own blockouts and coordinating their space of a shared blockout.
- J. Coordinate all interfaces between Mechanical and Electrical/Communications/Security Divisions before submitting any equipment for review or beginning installation.

1.3 ABBREVIATIONS

- A. MC: Mechanical Contractor = Divisions 21 through 23 Contractor who provides equipment and motor.
- B. TC: Temperature Controls = Division 25 1000 Contractor who provides control.
- C. EC: Electrical Contractor = Divisions 26 through 28 Contractor who provides power/data.
- D. FA: Fire Alarm Contractor = Division 28 Contractor who furnishes Fire Alarm System.

1.4 RESPONSIBILITY SCHEDULE

- A. Responsibility: Unless otherwise indicated, all equipment, motors, and controls for Divisions 21 through 23 equipment shall be furnished, set in place and wired in accordance with the following schedule:

ITEM -	Furnished Under	Set In Place Under	Power Wiring Under	Control Wiring Under
AHU Interior Marine Lights (Note 8)	MC	MC	MC	MC
AHU Light Switch	EC	EC	EC	EC
RTU Light Switch	MC	MC	EC	EC
Equipment Motors	MC	MC	EC	--
Automatically or Manually Controlled Starters/Contactors: (Note 4)				
-Separate	MC	EC	EC	TC
-Factory Mounted and Wired	MC	MC	EC	TC
Variable Frequency Drives				
-Separate	MC	EC	EC	TC
-Factory Mounted and Wired	MC	MC	EC	TC
In Motor Control Centers (Note 4)	EC	EC	EC	TC
Motor Speed Controllers: (Note 4)				
-Separate	MC	EC	EC	TC
-Factory Mounted and Wired	MC	MC	EC	TC
Disconnect Switches (Note 1)	EC	EC	EC	--
Thermal Overload Switches (Note 1)	EC	EC	EC	--

ITEM -	Furnished Under	Set In Place Under	Power Wiring Under	Control Wiring Under
Switches (Manual or Automatic other than disconnect) (Note 2)	MC or TC	MC or TC	EC or TC	TC or MC
Control Relays (Note 2)	MC or TC	MC or TC	--	TC
Control Transformers	TC	MC or TC	EC (120V)	TC
Thermostat and Controls: Integral with Equipment or Directly Attached to Ducts, Pipes, etc. (Note 2)	TC	MC or TC	TC	TC
Equipment in Temperature Control Panels	TC	TC	EC	TC
Standalone Control Panels (BAS) (Note 6)	TC	TC	EC (120V)	TC
Valve Motors, Damper Motors, Solenoid Valves, etc.	MC & TC	MC & TC	TC	TC
EP Valves or Switches, P.E. Switches, etc.	TC	TC	--	TC
Fire Alarm System (Note 3)	FA	FA	EC	FA
Fire Sprinkler Alarm (Note 3)	FA	FA	EC	FA
Duct System Smoke Detectors (Note 5)	FA	MC	EC	TC/FA
Relays for Fan Control via duct detectors (Note 5)	MC	EC	EC	FA
Room Smoke Detectors Including Relays for Fan Control (Note 3)	FA	EC	EC	EC
Smoke Management Curtain and Shutters (Note 6)			EC	EC/FA
CO Sensors	FA	FA	EC	FA
Equipment Interlocks	TC	TC	--	TC
Fire/Smoke and Smoke Dampers (Note 7)	MC	MC	EC	FA
Positive Indication Devices (i.e., current sensors, end switches, airflow sensors)	TC	TC	--	FA/TC
Freezer and Refrigerator Temperature Controls (Intrusion)	MC	MC	EC	EC
Domestic Water Flow Switch (Intrusion) Located downstream past the cooling tower. Provide 120V power.	MC	MC	EC	EC
Low Building Temperature Sensor (Intrusion)	MC	MC	EC	EC

B. Responsibility Schedule Notes:

1. If furnished as part of factory wired equipment furnished and set in place by MC, wiring and connections by EC.
2. If float switches, line thermostats, P.E. switches, time switches, or other controls carry the FULL LOAD CURRENT to any motor, they shall be furnished by MC, but they shall be set in place and connected by EC, except that where such items are an integral part of the mechanical equipment, or directly attached to ducts, piping, or other mechanical equipment, they shall be furnished and set in place by MC and connected by EC. If they do not carry the FULL LOAD CURRENT to any motor, they shall be furnished, set in place and wired by TC contractor.

3. Electrical contractor is responsible for wiring from starter to motor, unless factory wired.
 4. Temperature control contractor shall provide conduit and wire from auxiliary contact in motor starter to the detector so that the unit shuts down in all operating modes. Fire Alarm Contractor to wire from detector to fire alarm panel.
 5. Each division shall be fully responsible for any control panels as called for on the drawings or specifications.
 - a. Division 26 and 28 shall provide all power and control wiring to fire/smoke and/or smoke dampers. Division 23 shall provide parallel control wiring (with 28 fire alarm having priority signal) to dampers and equipment utilized in both normal and smoke control modes. Refer to Smoke Control and Fire Alarm Drawings and the Fire Alarm Matrix.
 - b. Fire alarm system shall override automated building control system during smoke exhaust mode.
 - c. TC wiring required only when damper also serves HVAC system.
 6. FA wires from the fire alarm control panel necessary for the initiation and monitoring of the Smoke Management System Control Panel. TC wires to components and smoke control fans and dampers utilized in the control and monitoring of the Automated Building Control System.
 - a. Provide 120V emergency circuit and fire alarm connections to each curtain and shutter. Coordinate exact locations with curtain and shutter contractor.
 7. Division 26 shall provide power to junction box on the exterior of the AHU.
- C. Power Wiring by Divisions 21 through 23: The electrical power for certain equipment provided under Divisions 21 through 23 has not been specifically indicated on the electrical drawings and must be provided by and field coordinated by the Divisions 21 through 23 trades requiring such power. Electrical contractor shall review Division 21 through 23 drawings and coordinate with said contractors to confirm power needs.
1. Sufficient power for this purpose shall be furnished as “spare” dedicated circuit capacity in Division 26’s panelboards. All wiring, conduit and electrical devices downstream of the panelboards are the responsibility of the Divisions 21 through 23 trades requiring the power.
 - a. Such equipment is hereby defined as:
 2. Electrical heat trace. Required heat trace locations, capacities and specification are shown on the plumbing drawings (Division 22 work).
 3. Dry-pipe control panels and valves. Required connections are included in the Division 21 work, and will be shown by that contractor’s engineered system design drawings.
 - a. Such equipment is hereby defined as:
 - b. Electrical heat trace. Required heat trace locations, capacities and specification are shown on the plumbing drawings (Division 22 work).
 - c. Fire protection air compressors, dry-pipe control panels and valves. Required connections are included in the Division 21 work, and will be shown by that contractor’s engineered system design drawings.
 - d. Pre-action system alarm and trouble initiation signals (such as smoke detectors or general alarm conditions in a pre-action zone) shall be

- provided under Division 28 fire alarm work.
- e. Division 21 shall provide pre-action control panel and interconnection between pre-action panel and location of pre-action valve(s). See Specification 21-5000 for FM 200.
 - f. Division 28 shall provide interconnection between fire command center alarm panel (provided under Division 28) and remote communication fire alarm panel (provided under Division 28).
- 4. Infrared plumbing fixtures. Fixtures requiring power are shown on the plumbing drawings and schedules. Provide junction box and or receptacle as required by manufacturer.
 - 5. Temperature control panels, control air compressors and line voltage power for 24v control transformers. Required connections are included in Division 23 09 00 and will be shown by that contractor's control submittal drawings.
 - 6. Condensate pumps. Provide power from associated unit or from nearby panelboard.
 - 7. BAS or Control System Gateways. Provide power from nearest panelboard and single data cable from nearest telecommunications room.

1.5 GENERAL REQUIREMENTS

- A. Special Requirements:
 - 1. Motors, starters and other electrical equipment installed in moist areas or areas of special conditions, such as explosion proof, shall be designed and approved for installation in such areas with appropriate enclosure.
- B. Building Management System Controls:
 - 1. Provide 120V circuit and single data cable to each building management control panel. Coordinate exact locations with controls contractor. See Specification 27-1500 / 27-1501.
 - 2. Low voltage wiring from J-boxes to distributed control components, all low voltage connections, all control panels and all control transformers (not part of unitary equipment) shall be provided under Division 23.
 - 3. Any additional power requirements shall be the responsibility of the Division 23 Contractor requiring same, and shall be provided at no additional cost to the owner.

1.6 CEILING AND CHASE CAVITY PRECEDENCE

- A. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electric systems within the A full-time competent Project Foreman shall be designated by the contractor to the Owner's Representative and shall be available, on site, for consultation to direct the work at all times. This individual, when appointed, will not be replaced without prior approval from the Owner's Representative. The Foreman shall be responsible for coordination and correct placing of the of work included in Divisions 26, 27 and 28. A full-time competent Project Foreman shall be designated by the contractor to the Owner's Representative and shall be available, on site, for consultation to direct the work at all times. This individual, when appointed, will not be replaced without prior approval from the Owner's Representative. The Foreman shall be responsible for coordination and correct placing of the of work included in Divisions 26, 27 and 28. A full-time competent Project Foreman shall be designated by the contractor

to the Owner's Representative and shall be available, on site, for consultation to direct the work at all times. This individual, when appointed, will not be replaced without prior approval from the Owner's Representative. The Foreman shall be responsible for coordination and correct placing of the of work included in Divisions 26, 27 and 28. A full-time competent Project Foreman shall be designated by the contractor to the Owner's Representative and shall be available, on site, for consultation to direct the work at all times. This individual, when appointed, will not be replaced without prior approval from the Owner's Representative. The Foreman shall be responsible for coordination and correct placing of the of work included in Divisions 26, 27 and 28. cavity space allocation in the following order of precedence. A system with higher precedence may direct that systems of lower precedence be relocated from space, which is required for expedient routing of the precedent system.

1. Plumbing waste, cooling coil drain piping, and roof drain mains and leaders.
 2. Condensate piping.
 3. Hydronic main piping (8" and larger).
 4. Plumbing vent piping.
 5. Supply, return and exhaust ductwork.
 6. Cable tray systems.
 7. Electrical conduit 4" diameter or greater.
 8. Hydronic branch and mains (greater than 2", but less than 8").
 9. Domestic water piping.
 10. Fire sprinkler mains and leaders.
 11. Hydronic branch piping (2" and less).
 12. Domestic hot and cold-water branches.
 13. Electrical branch conduits.
 14. Pneumatic control piping.
 15. Fire sprinkler branch piping and sprinkler runouts.
- B. Light fixtures have precedence in a zone, which is the same height above the ceiling as the depth of the fixture (plus 2").
- C. Examine the contract documents of all trades (e.g. all Divisions 21 through 23 and 26 through 28 drawings, the architectural floor plans, reflected ceiling plans, elevations and sections, structural plans and sections, etc.).
- D. Coordinate necessary equipment, ductwork and piping locations so that the final installation is compatible with the materials and equipment of the other trades.
- E. Prepare shop drawings for installation of all new work before installation to verify coordination of work between trades.
- F. Provide access doors for all electrical and communications equipment which require access for adjustment or servicing and which are in otherwise inaccessible locations. All access door locations must be approved by the architect prior to installation and be in as inconspicuous location as possible.
1. For equipment located in "accessible locations" such as lay-in ceilings: Locate equipment to provide adequate service clearance for normal maintenance without removing architectural, mechanical, electrical or structural elements such as the ceiling support system, electrical fixtures, etc. "Normal maintenance" includes, but is not limited to: replacement of drivers, fuses, etc.

1.7 BLOCKOUT USAGE

- A. Electrical and Mechanical Contractors shall review the contract documents and advise if additional blockouts are necessary for the execution of work. Electrical and Mechanical Contractors shall coordinate and hold meetings with other contractors who will occupy the blockouts to ensure sufficient space is allocated for their scope of work. It is not acceptable to delay this meeting until conduit/piping/tray is being installed. Change orders are not acceptable due to a lack of contractor coordination prior to commencing rough in.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 26 0501

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SECTION 26 0502 - ELECTRICAL SUBMITTALS AND O & M MANUALS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to all Division 26, 27 and 28 sections.
- B. Architectural, Structural, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full. Contractor must review the entire set of plans and specifications. Reviewing only the electrical set is not acceptable.
- C. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 SUBMITTAL REQUIREMENTS:

A. GENERAL:

- 1. After the Contract is awarded but prior to ordering, manufacture, or installation of any equipment, prepare complete Submittals including shop drawings, product data, brochures, etc. for materials and equipment as required by each section of the specification.
- 2. Review of Submittals shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from the Contract Document's requirements. It shall be clearly understood that the noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Document's shall govern and are not waived, or superseded in any way by the review of the Shop Drawings and Brochures.
- 3. Submittals are reviewed, not approved. Comments made within submittals do not alter the contract documents in any way. The contractor is still responsible, regardless of comments (if any) made within submittals, for complying with drawings and specifications.
- 4. Notify engineer in writing if any of the comments noted in the submittals alter the contract cost. A comment within the submittal process which increases/decreases cost of product is not an authorization to the contractor under any circumstances to proceed.
- 5. Notify engineer of any modifications between contract documents and submittals. It is the responsibility of the contractor to ensure compliance.
- 6. ELECTRONIC SUBMITTAL REQUIREMENTS:
 - a. Provide submittals in Portable Document Format (PDF).
 - b. Documents must be electronically bookmarked and keyword searchable using Adobe Acrobat (<http://www.adobe.com/acrobat>) or Bluebeam Revu (<http://www.bluebeam.com>) for each relevant section. For example, include electronic bookmarks separating "Light Fixtures" from "Panelboards".

- c. Electronically highlight all options for light fixtures, electrical equipment, etc. Manual highlighting and scanning of the documents is NOT acceptable and will NOT be reviewed.
- d. Provide only completed cutsheets for all fixture and equipment types. Blank cutsheets submitted with a schedule are NOT acceptable and will NOT be reviewed.
- e. At the time of submission, the electrical contractor shall provide a complete and comprehensive submission of all required specification sections/shop drawings at the same time. Exceptions may be given, with prior approval, for time-sensitive equipment.
- f. A maximum of one submittal per specification section is allowed. It is NOT acceptable to provide a product by product submittal. Single product by product submittals will NOT be reviewed.

B. SCHEDULING

1. GENERAL

- a. A minimum period of two weeks, exclusive of transmittal time, will be required each time Submittals are submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling submittal data.
- b. If the shop drawings are rejected twice, the contractor shall reimburse the engineer the sum of \$1,200.00 for the third review and any additional reviews required prior to commencement of the third review.

C. QUALITY ASSURANCE

1. PRE-SUBMITTAL PREPARATION

- a. Prior to submission of the Shop Drawings and Project Data, review and certify that they are in compliance with the Contract Documents. Verify all dimensional information to ensure proper clearance for installation of equipment.
- b. Shop drawings requiring the use of electronic documents (floor plans, Lighting plans, fire alarm plans, etc.) shall be requested via a request for information (RFI) through the general contractor. Electronic documents will be provided to the Architect for distribution. No direct vendor requests will be accepted.
- c. Contractor is completely responsible for the content of the submittal

2. SUBMITTAL REQUIREMENTS

- a. Certifications shall be written or in the form of rubber stamp impressions as follows:

- i. I hereby certify that this Shop Drawing and/or Brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Drawings and Specifications for this Project.

(Name of Electrical Subcontractor)

Name _____.

Position _____ Date _____.

- b. Brochures to be submitted shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures submitted shall contain only information relevant to

the particular equipment or materials to be furnished. The Contractor shall not submit catalogs that describe several different items in addition to those items to be used, unless all irrelevant information is marked out, or unless relevant information is clearly marked. Brochures from each manufacturer shall be identified and submitted separately.

c. Shop Drawings shall be done in an easily legible scale and shall contain sufficient plans, elevations, sections, and isometrics to clearly describe the equipment or apparatus, and its location. Drawings shall be prepared by an Engineer/Draftsmen skilled in this type of work. Shop Drawings shall be drawn to at least 1/4" = 1'0" scale.

d. Observe the following rules when submitting the Shop Drawings and Brochures.

i. Each Shop Drawing shall indicate in the lower right hand corner, and each Brochure shall indicate on the front cover the following: Title of the sheet or brochure, name and location of the building; names of the Architect and Electrical Engineer, Contractor, Subcontractors, Manufacturer, Supplier/Vendor, etc., date of submittal, and the date of correction and revision. Unless the above information is included the submittal will be returned for resubmittal.

1. Submittal Identification shall include the following:

a. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted.

b. Original submittal numbers shall have the following format: "XXX-Y;" where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for resubmittals (for example, A, B, or C being the first, second, and third resubmittals, respectively). Submittal 25B, for example, is the second resubmittal of Submittal 25.

e. SPECIFICATION section and paragraph to which submittal applies.

D. POST-SUBMITTAL

1. Check all materials and equipment after arrival on the job site and verify compliance with the Contract Documents.

1.3 PROVIDE SUBMITTALS AS REQUESTED FOR EACH OF THE SECTIONS LISTED BELOW:

A. 26 0519 Conductors and Cables

1. (600V and Below)

a. Submit megohmmeter test data for circuits under 600 volts.

2. Conductors and Cables (Medium and Low Voltage)

a. Submit manufacturer's data on electrical cable and connectors for use above 600 volts. Upon request of Architect/Engineer, submit certificate of compliance indicating that cable has been tested in accordance with ICEA

- S-68-516, AE16 #6 and UL Standard 1072, and meets or exceeds minimum requirements.
- b. Submit test data in accordance with IEEE Standard 400-2001 showing ambient conditions, voltage levels, level durations, and conduction current for each step. Include effective insulation resistance in submittal.
 - c. Submit medium voltage cable Splicer/Terminator certification of competency and experience 20 days before splices or terminations are made in medium voltage cables. Splicer/Terminator experience during the immediate past 3 years shall include performance in splicing and terminating cables of the type and classification being provided under this contract.
- B. 26 0526 Grounding
- 1. Submit the name of test agency to be used for testing specified in this section. Submit results of tests specified in this section. Also include test results in Operation and Maintenance Manuals as specified.
- C. 26 0532 Conduit Raceway
- 1. Submit manufacturer's data on Power & Control/Signal Cable.
- D. 26 0533 Electrical Boxes and Fittings
- 1. Submit manufacturer's data including specifications, installation instruction and general recommendations for each type of floor box used on project.
- E. 26 0536 Raceway Systems
- 1. Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of raceway as follows: Surface Metal Raceways, Cable Tray Systems, Overhead metal raceways, Wire basket cable tray systems
 - 2. Submit dimensioned drawings of raceway systems showing layout of raceways and fittings, spatial relationships to associated equipment, and adjoining raceways, for each type of raceway as follows: Surface metal Raceways, Cable Tray Systems, Overhead metal raceways, Wire basket cable tray systems
- F. 26 0548 Electrical Seismic Control
- 1. A single submittal shall be provided for all seismic anchorage and restraints for all Division 26 equipment and systems provided as part of this project. Individual submittals for specific systems will not be accepted.
 - 2. Submit shop drawings, calculations, and printed data for the following items under provisions of the General Conditions of the Contract:
 - a. Complete engineering calculations and shop drawings for all seismic requirements for all equipment to be restrained as outlined in Section 26 0548 Specification, and as detailed on drawings.
 - b. The professional seal of the engineer who is responsible for the design of the Seismic Restraint System.
 - c. Details for all seismic bracing.
 - d. Details for steel frames, concrete inertia bases, and housekeeping pads. Include dimensions, embed depths, dowelling details, and concrete reinforcing requirements.
 - e. Clearly outlined procedures for installing and adjusting the isolators,

- seismic bracing anchors, snubbers, cables, and bolt connections.
- f. Floor plan noting the locations, size, and type of anchorage and restraint to be used.
 - g. Include confirmation that all calculations are based on the design criteria listed in appropriate Section.
 - h. Certificate of Compliance.
 - i. Where equipment is exempt per this specification provide a written certificate of compliance for each of the systems noted with the professional seal of engineer who has reviewed the electrical system.
- G. 26 0553 Electrical Identification
1. Submit manufacturer's data on each type of electrical identification products
 - a. Submit one sample of each component of the electrical identification system as follows: Wire/cable tape marker, Tags, Engraved, plastic laminate labels, Arc-flash hazard labels
- H. 26 0573 Protective Device Study
1. Submit partial study that includes the calculated values for short circuit current availability and arc flash levels for each switchgear bus, medium voltage controller, switchboard, low voltage motor control center, distribution panelboard, automatic transfer switch, and branch circuit panelboard. This data shall be submitted prior to, or at the same time as, submitting the entire electrical gear package. Contractor shall utilize construction drawings to estimate approximate feeder lengths for this preliminary submittal. Submitted data shall include equipment/panel designations, feeder conductor sizes, feeder lengths, and calculated short circuit values and arc flash levels. Include the utility transformer ratings and transformer impedances used for the preparation of the short circuit calculations.
 2. Construction Period Submittal: During the construction period but prior to application of utility power to the electrical distribution system, submit an indexed copy of the complete protective device study based on actual field values. Include the following:
 - a. Introductory section with basic formulas, pertinent data, and rationale employed in the study.
 - b. One-line diagram for that portion of the system included in the study.
 - c. Calculations section showing tabulated calculations.
 - d. Results, recommendations, settings, etc.
 3. Provide one revision to study based on engineering review comments for the completed study to allow for minor modifications to adjustable circuit breakers to minimize arc flash levels.
- I. 26 0923 Occupancy Sensors
1. Submit manufacturer's data on occupancy sensors, control modules, wiring diagrams, interconnection diagrams and any related accessories.
 2. Submit scaled drawings with lighting fixtures shown clearly marked by manufacturer showing proper product, location and orientation of each sensor.
- J. 26 0943 Lighting Control Equipment
1. Submit manufacturer's data on lighting control equipment including, but not limited to published catalog data sheets, rough-in diagrams and instructions for

- installation, operating and maintenance, suitable for inclusion in maintenance manuals.
2. Meet with the electrical engineer at their office prior to preparation of shop drawings to discuss and verify specific programming and zoning requirements of system(s).
 3. Meet with the lighting representative/manufacturer of the approved and accepted lighting control equipment to verify and understand specific installation requirements associated with that system.
 4. Submit detailed drawings and documentation of lighting control components and interconnection including, but not necessarily limited to:
 - a. Electronic controllers
 - b. Control stations
 - c. Photo sensors
 - d. Occupancy sensors
 - e. Network wiring details
 - f. Input and output wiring details
 - g. Lighting control panel load schedules
 - h. Provide a complete sequencing and programming schedules for all devices, zones and scenes.
 - i. Wallstations layouts
 - j. Accurately scaled equipment layouts, wire/cable routing and connections to control wiring and electrical power feeders.
- K. 26 1010 Energy & Power Metering System
1. Submit manufacturer's data on all components.
 2. Submit riser diagrams and interconnection diagrams, wiring layouts etc. for advanced metering system including low voltage wiring interconnections; and communications and data line interconnections to system components and to the BAS/BMS (Building Automation System/Building Management System) equipment.
 3. The external wiring interconnections required by the electrical contractor shall be clearly identified on the shop drawings.
- L. 26 2200 Transformers
1. Submit manufacturer's data on transformers, including certification of transformer performance efficiency, percentage regulation at 100 percent and 80 percent power factor, no-load and full load losses in watts, percent impedance at 75 degrees C, hot-spot and average temperature rise above 40 degrees C ambient, sound level in decibels, and standard published data. Before submitting product data, verify that dimensions of units to be supplied allow proper code required clearances adjacent to unit.
 2. Submit dimensioned drawings of transformer installations, showing layout, mountings and supports, and spatial relationship to proximate walls and equipment.

3. For types and ratings required, furnish additional fuses, amounting to one unit for every five installed units, but not less than three units of each (including ELSP fuses when specified).
- M. 26 2413 Switchgear and Switchboards
1. Submit manufacturer's data on switchgear and switchboards.
 2. Submit dimensioned drawings of switchgear and switchboards showing accurately scaled basic sections including, but not necessarily limited to, auxiliary compartments, section components, and combination sections. Show plan view of equipment with dimensioned clearances to proximate equipment. Failure to submit said plan view shall not relieve contractor of responsibility to verify required clearances before release of equipment for fabrication.
 3. Submit manufacturer's data and shop drawings only after completion of the preliminary protective device study (see Section 26 0573 as applicable). Any Section 26 2413 submittals received prior to submission of the preliminary protective device study will be REJECTED.
 4. For types and ratings required, furnish additional fuses, amounting to one unit for every 5 installed units, but not less than 3 units of each.
- N. 26 2416 Panelboards
1. Submit dimensioned drawings of panelboards and enclosures showing accurately scaled layouts of enclosures and required individual panelboard devices, including but not necessarily limited to, circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, and accessories.
 2. Submit manufacturer data including specifications, installation instructions and general recommendations, for each type of panelboard required.
 3. Submit manufacturer's data and shop drawings only after completion of the preliminary protective device study (see Section 26 0573 as applicable). Any Section 26 2416 submittals received prior to submission of the preliminary protective device study will be REJECTED.
- O. 26 2713 Service Entrance
1. Submit manufacturer's data on service-entrance equipment and accessories.
 2. Submit dimensioned layouts of service-entrance equipment and spatial relationships to proximate equipment. Failure to submit said layouts shall not relieve contractor of responsibility to verify required clearances before release of equipment to fabrication.
 3. Submit manufacturer's data and shop drawings only after completion of the preliminary protective device study (see Section 26 0573 as applicable). Any Section 26 2713 submittals received prior to submission of the preliminary protective device study will be REJECTED.
 4. For types and ratings required, furnish additional fuses, amounting to one unit for every 2 installed units, but not less than one unit of each.
- P. 26 2726 Wiring Devices
1. Submit manufacturer's data on electrical wiring devices.
- Q. 26 2815 Overcurrent Protective Devices
1. Submit manufacturer's data on overcurrent protective devices, including catalog cuts, time-current trip characteristic curves, and mounting requirements.

2. Submit layout drawings of overcurrent protective devices, with layouts of circuit breakers, including spatial relationships to proximate equipment. Failure to submit said spatial layouts does not relieve contractor of responsibility to verify all required clearances before release of equipment for fabrication.
 3. Submit manufacturer's data and shop drawings only after completion of the preliminary protective device study (see Section 26 0573 as applicable). Any Section 26 2815 submittals received prior to submission of the preliminary protective device study will be REJECTED.
 4. For types and ratings required, furnish additional fuses, amounting to one unit for every 5 installed units, but not less than two units of each size and type, unless specified otherwise in another section of these specifications.
 5. Submit time-current trip curves (in log-log format) and trip setting parameter/range information (for each trip function) for all solid-state circuit breakers.
 6. Manufacturer shall also provide recommended trip settings with the shop drawing submittal (including ground fault settings) for coordination with downstream overcurrent devices. Manufacturer shall base recommendations on the AIC rating of the electrical equipment.
 7. Where the Protective Device Study specification section 260573 is included in the project, the time-current curves and recommended trip settings for all solid-state circuit breakers shall be submitted as part of the protective device study.
- R. 26 2816 Motor and Circuit Disconnects
1. Submit manufacturer's data including specifications, installation and general recommendations, for each type of motor and circuit disconnect switch required.
 2. Submit dimensioned drawings of electrical motor and circuit disconnect switches that have rating of 100 amperes and larger.
- S. 26 2913 Motor Starters
1. Submit manufacturer's data on motor starters.
 2. Submit dimensioned drawings of motor starters showing accurately scaled equipment layouts.
 3. After installation is complete, including water and air balancing, measure voltage (L-L and L-N) and full load current of each phase of each motor. Submit report showing field readings of voltage, amperage, service factor, and thermal heater size installed for each motor.
- T. 26 3100 Turnkey Photovoltaic (PV) Renewable Energy System
1. See Section for requirements.
- U. 26 3213 Emergency Electrical Systems
1. Dimensioned drawings of emergency electrical system components and accessories including, but not necessarily limited to generator sets, isolation/by-pass switches, day tanks, transfer switches, instruments and accessories, (and) annunciator panels, (and) fuel line and exhaust piping). Show accurately scaled layouts of system components; indicate their spatial relationship to associated equipment; show connections to normal and emergency power feeders. Failure to submit said scaled lay-outs does not relieve contractor of responsibility to verify all required clearances before release of equipment for fabrication.
 2. Manufacturer's standard catalog data describing and depicting each engine-generator set, batteries, charger, tanks, and all ancillary equipment in sufficient

detail to demonstrate complete specification compliance.

3. Drawings depicting each of the following:
 - a. Base mounted equipment, with base and all attachments including anchor bolt template and recommended clearances for maintenance and operation.
 - b. Complete starting system, fuel system, cooling system, and exhaust system.
 - c. Electric wiring of relays, breakers, and switches with applicable single line and wiring diagrams and written description of operation and the instrumentation provided.
 - d. Enclosure (if applicable).
 4. Manufacturer's standard catalog data describing and depicting each transfer and by-pass isolation switch along with all ancillary equipment in sufficient detail to demonstrate complete specification compliance. In addition provide the following:
 - a. One-line diagram of each switch assembly and wiring diagram of each unit.
 - b. A complete list of equipment and material to be provided, containing an adequate description of each separate item of equipment.
 5. Submit four complete sets of operating manuals for each item of equipment and/or component outlining the step-by-step procedure required for system start up, operation, and shutdown. Include the manufacturer's name, model number, and a description of all equipment, complete with basic operating features. Describe in detail all maintenance procedures and a troubleshooting guide listing possible breakdowns and repairs for each piece of equipment. Include all factory service manuals, complete parts lists, simplified schematic diagrams of each system as installed, and the original. Include complete test reports specified in Part 3-Execution herein.
- V. 26 3533 Power Conditioning Systems
1. See Section for requirements.
- W. 26 4313 Surge Protective Devices (SPD)
1. Submit manufacturer's data on SPD's listing all performance ratings specified or required herein.
 2. Submit dimensioned drawings of SPD's including, but not necessarily limited to, the following.
 - a. Complete data sheet.
 - b. Set of outline drawings giving complete mounting information, conduit entry and exit locations and dimensions, overall unit dimensions, weights, physical characteristics, etc.
 - c. Set of complete electrical drawings for power and control wiring.
 - d. Manufacturer's literature giving detailed information of equipment including parts numbers, model numbers and ratings.
 - e. UL 1449 suppressed voltage rating documentation.
- X. 26 5100 Interior and Exterior Building Lighting
1. Submit manufacturer's data on interior and exterior building lighting fixtures.

2. Submit dimensioned drawings of lighting fixtures. Submit fixture shop drawings in PDF format with separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with proposed fixture catalog number and accessories clearly indicated on each sheet.
 3. When applicable submit standard color samples with the shop drawings. If standard colors are not acceptable, a color sample will be provided to the fixture manufacturer. Return of the shop drawings will be delayed until color samples are provided.
 4. Submit driver manufacturer cut sheets.
 5. Submit a list of all lamps used on projects.
 - a. Stock of all spare items shall be delivered as directed to Owner's storage space. All components shall be labeled to match construction document nomenclature,
- Y. 26 5600 Exterior Area Lighting
1. Submit manufacturer's data on lighting units, including certified dimension drawings of components including, but not necessarily limited to, poles and standards, mast arms, brackets, hardware and fixtures.
- Z. 27 1500 Structured Cabling Systems
1. See District Specification for more information regarding submittal requirements.
 2. Provide electronic submittals in Adobe PDF format within one file. Organize pages within submittal to be in the same order as the specification items (for example, racks prior to cabling). Where multiple submittals are provided due to submittal. If three or more reviews are required of the 27-1500 submittals, Contractor shall reimburse the Engineer for \$1,200 before the Engineer will commence the third review. rejections/corrections, upon completing the submittal process with "No Exceptions Taken", provide a consolidated single PDF submittal showing all products on the project.
 3. Provide proof of RDIGITAL COPYD certification and connectivity manufacturer certification.
 4. Provide submittals for all racks/cabinets; patch panels, devices, cabling, firestopping solutions, tray, non-continuous cable support devices, grounding equipment, and miscellaneous equipment to be used on project. Where multiple part numbers are listed on a datasheet/cutsheet, highlight or circle applicable part.
 5. Provide submittals showing complete racking layout in plan and elevation view to scale. Coordinate exact rack layout with Owner Information Technology Representative prior to submittal.
 6. Provide color samples of all available standard color faceplates to architect.
 7. Provide proposed labeling scheme for approval by owner/engineer.
 8. Provide catalog cutsheets of all test equipment that will be used.
 9. Provide results of all copper and fiber optic cable tests.
- AA. 27 4100 Audiovisual Systems
1. The following items shall be included in the shop drawings submittal:
 - a. Project manager's written proof, with signature and date, that shop drawings and/or brochure has been checked for accuracy prior to

- submittal. Shop drawings to comply in all respects with the requirements of the contract drawings and specifications for this project.
- b. A complete bill of materials, broken out per system type, for all components, accessories and hardware to be provided in order to assemble a complete and working system as described within the contract documents.
 - i. The bill of material is intended to be used to verify equipment within each system. Only one cut sheet per unique product type is required.
 - ii. Example several systems may require the same flat panel display mount, that mount should be listed in each system type with only one (1) cut sheet provided for that product.
 - c. Manufacturer's data sheets and installation details for all devices, plates, cables and similar equipment. Product data showing multiple options, products and/or models shall be clearly marked identifying the specific options, products and/or models being provided.
 - d. Signal flow drawings showing all audio, video, control, network and power connections required between all pieces of equipment within each system.
 - i. Unique cable/wire identifier for each connection that correspond to field cabling labelling scheme.
 - ii. All connections require connector type and sex to be identified. Type shall correspond to a connector legend or shall be clearly identified per instance.
 - iii. Wiring pinouts for all multipin connectors used
 - iv. Detailed panel drawings showing wall, floor, rack, etc. input/output panel dimensions, connector types and text labeling for each connection shown
 - v. Physical location information for each device.
 - vi. Upon request AV Consult's signal flow drawings may be utilized for signal flow documentation within the shop drawings, provided, the items above are included. Contractor shall make request for electronic files as indicated in section 1.2.C.
 - e. Equipment rack elevations.
 - f. Matrix routing and preset configuration tables, and digital signal processing configuration details.
 - g. Wireless microphone transmission frequencies.
 - h. Submit all manufacturer training, 3rd party and/or organization certificates for each equipment and/or systems required for the implementation of this specification.
 - i. Provide current equivalent if specified model has been discontinued.
2. All touch panel layouts, page logic functions and control system functionality, shall be submitted and approved by the Owner and AV Consultant prior to installation and programming of the control systems. Contractor shall submit the following information at the following stages during the construction of the GUI.

- a. Draft Stage: Draft drawings and/or sketches of; basic layouts, button details, text details and page flip progression. Include control schemes for all applicable devices in system.
 - b. Intermediate Stage: Intermediate Touch Panel Menus designed with manufacturer's software. Submit printouts and/or software files for review. Include detailed layouts, extensive control schemes for all controlled components, comprehensive button and text configurations, page flips and pop-up progression. Incorporate any changes or comments from previous stage mentioned above.
 - c. Demo Stage: Provide an active Touch Panel and controller to extensively demonstrate the operation of the control system. Demo of system shall be subject for review and considered as a deliverable. Include all revised detailed layouts, extensive control schemes for all controlled components, comprehensive button and text configurations, page flips and pop-up progression. Incorporate any changes or comments from the previous stage mentioned above.
 - d. Final Stage: Submit Final Touch Panel Menus designed with manufacturer's software. Submit printouts and software files for review. Include all detailed layouts, all revised control schemes for all controlled components, revised button and text configurations, page flips and pop-up progression. Include final page configurations for control of system from the touch panel. Incorporate any and all changes or comments from the previous stage mentioned above.
- BB. 27 5123 Intercommunication Systems
1. Provide a complete bill of materials for all components, accessories and hardware to be provided in order to assemble a complete and working system as described within the contract documents.
 2. Provide wiring layouts for Audio, Video, Control, and power.
- CC. 28 1600 Intrusion Detection System
1. Submit manufacturer's data sheets including specifications, installation instructions, and general recommendation for each type of equipment specified.
 2. Submit dimensioned drawings and wiring layout for any changes in wiring from the layout on the drawings. Submit actual riser diagrams of complete system and elevations of required equipment. Typical risers are not acceptable.
 3. Contractor to provide a list of IP addresses of network devices with location and model #s.
- DD. 28 2205 Access Control System
1. Submit manufacturer's data sheets including specifications, installation instructions, and general recommendation for each type of equipment specified.
 2. Submit dimensioned drawings and wiring layout for any changes in wiring from the layout on the drawings. Submit actual riser diagrams of complete system and elevations of required equipment. Typical risers are not acceptable.
 3. Submit network switch port count and power requirements. Port count and POE switch requirements should be broken out per IDF/MDF closet.
 4. Submit manufacturer certifications for all systems provided. Certifications must be from local office providing the install.

5. Provide the Owner the following upon project completion:
 - a. A complete set of shop drawings indicating: Locations of all panels, power supplies and controllers; point-to-point wiring diagrams for all devices.
 - b. A complete equipment list identifying: Type; model; manufacturer; manufacturer's data sheets.
 - c. A list of IP and MAC addresses, username and passwords for network devices coordinated with door name and/or location.
 - d. Serial and model numbers for all major components.
 - e. Installation manuals and user manuals for all systems listed in these specifications.
- EE. 28 2300 IP Video Surveillance System
1. Submit dimensioned drawings and wiring layout for any changes in wiring from the layout on the drawings. Submit actual riser diagrams of complete system and elevations of required equipment. Typical risers are not acceptable.
 2. Submit network switch port count and power requirements. Port count and POE switch requirements should be broken out per IDF/MDF closet.
 3. Submit manufacturer certifications for all systems provided. Certifications must be from local office providing the install.
 4. Mid-span power budget calculations showing power requirements for all cameras.
 5. Provide the Owner the following upon project completion:
 - a. A complete set of shop drawings indicating: Locations of all cameras, power supplies and controllers; point-to-point wiring diagrams for all devices.
 - b. Locations of all cameras with custom painted enclosures due to wood ceilings.
 - c. Contractor to provide a list of IP address for cameras coordinated with camera name and/or location.
- FF. 28 3111 Fire Alarm and Detection System
1. Submit manufacturer's data on fire alarm and detection systems including, but not limited to, roughing-in diagrams and instructions for installation, operating and maintenance, suitable for inclusion in maintenance manuals.
 2. Provide shop drawings showing equipment/device locations and connecting wiring of entire fire alarm and detection system. Include wiring diagrams and riser diagrams of panel. Provide dimensioned drawing of Fire Alarm Control Panel and Building Graphic. Shop drawings shall be prepared by an individual with a minimum NICET Level IV (Fire Protection Engineering/Fire Alarm Systems) certification. The individual's name and certification number shall be indicated on submittal design drawings.
 3. Submit a written statement to the Architect and the state and local Fire Marshal's Office that each device of the fire alarm system will be installed, inspected and tested in accordance with applicable requirements of NFPA Standard 72.
 4. Submit a complete set of documents to the Office of the State Fire Marshal containing the following information:

- a. A complete set of shop drawings indicating:
 - i. Location of all alarm-initiating and alarm-signaling devices.
 - ii. Point-to-point wiring diagrams for all alarm-initiating and alarm-signaling devices.
- b. Wiring diagrams for:
 - i. Alarm control panels.
 - ii. Auxiliary function relays and solenoids.
 - iii. Remote signaling equipment.
 - iv. Standby battery calculations, including voltage drop calculation.
- c. A complete equipment list identifying:
 - i. Type
 - ii. Model
 - iii. Manufacturer
 - iv. Manufacturer catalog data sheets
 - v. UL Listing and/or FM approval showing compatibility of device with Fire Alarm Control Panel (FACP)
- d. A complete zone list identifying all:
 - i. Alarm-initiating and alarm-signaling devices.
 - ii. Remote signaling and auxiliary function zones.
 - iii. Specific devices associated with each zone.
- e. Sample "System Record Document".
- f. Fire Alarm Key Plan Drawing showing the location of all device addresses and/or zones.

5. Address all comments from the Fire Marshal and instigate changes to the systems as applicable. Re-submit documents indicating changes instigated for final approval.

1.4 OPERATION & MAINTENANCE MANUALS

- A. Provide operating instruction and maintenance data books for all equipment and materials furnished under this Division.
- B. Submit four copies of operating and maintenance data books for review at least four weeks before final review of the project. Assemble all data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item. The binder (sized to the material) shall be a 2" slide lock unit (Wilson-Jones WLJ36544B). The cover shall be engraved with the job title in 1/2" high letters and the name and address of the Contractor in 1/4" high letters. Provide the same information in 1/8" letters on the spine.
- C. Include complete cleaning and servicing data compiled in clearly and easily understandable form. Show serial numbers of each piece of equipment, complete lists of replacement parts, motor ratings, etc. Each unit shall have its own individual sheet. (Example: If two items of equipment A and D appear on the same sheet, an individual sheet shall be provided for each unit specified).

- D. Include the following information where applicable.
1. Identifying name and mark number.
 2. Certified outline Drawings and Shop Drawings.
 3. Parts lists.
 4. Performance curves and data.
 5. Wiring diagrams.
 6. Light fixture schedule with the lamps and ballast data used on the project for all fixtures
 7. Manufacturer's recommended operating and maintenance instructions.
 8. Vendor's name and address for each item.
- E. The engineer will review the manuals and when approved, will forward the manuals on to the architect. If the manuals are rejected twice, the contractor shall reimburse the engineer the sum of \$1,200.00 for each review afterwards.
- F. Provide high quality video and audio recording for all training sessions. All trainings shall be recorded by utilizing a pro-grade digital camera system. Utilize camera tripod and record audio directly at the presenter. Smartphone recordings are not allowed.
- G. Provide Operation and Maintenance Manual information for each section listed below in addition to the general requirements listed above.
1. 26 0526 Grounding
 - a. Test Results of measured resistance values
 2. 26 0548 Electrical Seismic Control
 - a. Certificate of Compliance from Final Inspection
 3. 26 0923 Occupancy Sensors
 - a. Record Drawings
 - i. A complete set of 'as-builts' drawings showing installed wiring, specific interconnections between all equipment, and internal wiring of this equipment shall be included in the operating and maintenance manuals upon complete of the system.
 - ii. Provide a DIGITAL COPY to the owner containing the information specified below. The DIGITAL COPY shall include all information required to allow the Owner to change the schedules themselves. The DIGITAL COPY shall contain a minimum of following:
 1. CAD drawing files of 'as-built' lighting control components and point to point connections.
 2. General configuration programming.
 3. Job specific configuration programming to include schedule.
 4. Tutorial file on complete programming of lighting control system.
 4. 26 0943 Lighting Control Equipment
 - a. Record Drawings

- i. A complete set of 'as-builts' drawings showing installed wiring, specific interconnections between all equipment, and internal wiring of this equipment shall be included in the operating and maintenance manuals upon complete of the system.
 - ii. Provide a DIGITAL COPY to the owner containing the information specified below. The DIGITAL COPY shall include all information required to allow the Owner to change the schedules themselves. The DIGITAL COPY shall contain a minimum of following:
 - 1. CAD drawing files of 'as-built' lighting control components and point to point connections.
 - 2. General configuration programming.
 - 3. Job specific configuration programming to include schedule.
 - 4. Tutorial file on complete programming of lighting control system.
5. 26 2913 Motor Starters
- a. After installation is complete, including water and air balancing, measure voltage (L-L and L-N) and full load current of each phase of each motor. Submit report showing field readings of voltage, amperage, service factor, and thermal heater size installed for each motor.
6. 26 3213 Emergency Electrical System
- a. Manual Requirements
 - i. Submit four complete sets of operating manuals for each item of equipment and/or component outlining the step-by-step procedure required for system start up, operation, and shutdown. Include the manufacturer's name, model number, and a description of all equipment, complete with basic operating features. Describe in detail all maintenance procedures and a troubleshooting guide listing possible breakdowns and repairs for each piece of equipment. Include all factory service manuals, complete parts lists, simplified schematic diagrams of each system as installed, and the original. Include complete rest reports specified in Section 26 3213.
 - b. Test Results as outlines in Section 26 3213
7. 26 0943 Lighting Control Equipment
- a. Record Drawings
 - i. A complete set of 'as-builts' drawings showing installed wiring, specific interconnections between all equipment, and internal wiring of this equipment shall be included in the operating and maintenance manuals upon complete of the system.
 - ii. Provide a DIGITAL COPY to the owner containing the information specified below. The DIGITAL COPY shall include all information required to allow the Owner to

change the schedules themselves. The DIGITAL COPY shall contain a minimum of following:

1. CAD drawing files of 'as-built' lighting control components and point to point connections.
 2. General configuration programming.
 3. Job specific configuration programming to include schedule.
 4. Tutorial file on complete programming of lighting control system.
8. 26 5100 Interior and Exterior Building Lighting
- a. The supply two complete manuals consisting of, as a minimum, general system arrangement, lighting cutsheets, schematic of System components and options, factory test reports, trouble-shooting data, parts lists, preventative maintenance information, and warranty contact information.
9. 27 1010 Structured Cabling Systems
- a. Test Results and requirements as outlined in Section 27 1010
 - b. Manual shall include all service, installation, programming and warranty, including test results for each cable.
 - c. Provide laminated plans (minimum size 11 x 17) of all telecommunications record drawings (including riser diagrams) in each and every EF, ER and TR.
 - d. Record Drawings
 - i. The Owner shall provide electronic (DWG) format of telephone/data system drawings that as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.
 - ii. Provide a complete set of "as built" drawings in paper and electronic (DWG and PDF) formats showing cabinets, racks, patch panels, wiring, specific interconnections between all equipment and internal wiring of equipment within 30 working days of completion. Drawings are to include all labeling information used in denoting equipment used in the installation. Labeling, icons, and drawing conventions used shall be consistent throughout all documentation provided.
10. 275123 Intercommunications Systems
- a. Manual Requirements
 - i. Operating and maintenance manuals shall be submitted prior to testing of system. Manuals shall include all model numbers, service, installation, and programming information.
 - ii. Include all the following information:
 1. Warranty

2. Network settings
 3. Riser diagrams from Shop drawings
 4. Training videos
 5. Flash drive with programing source code and software editing programs
 - b. Record Drawings
 - i. The Owner shall provide electronic (DWG) format of intercom System system drawings that as-built construction information can be added to. These documents will be modified by the intercom contractor to denote as-built information as defined above and returned to the Owner.
 - ii. Provide a complete set of "as built" drawings in paper and electronic (DWG and PDF) formats showing cabinets, racks, patch panels, wiring, specific interconnections between all equipment and internal wiring of equipment. Drawings are to include all labeling information used in denoting equipment used in the installation. Labeling, icons, and drawing conventions used shall be consistent throughout all documentation provided.
11. 27 3244 Two-Way Communication system
 - a. Record Drawings
 - i. Provide As-Built drawings that include changes to wiring, wiring designations, junction box labeling, and other pertinent information.
12. 27 4110 Audiovisual Systems
 - a. Manual Requirements
 - i. Operating and maintenance manuals shall be submitted prior to testing of system. Manuals shall include all model numbers, service, installation, and programming information.
 - ii. Include all the following information:
 1. Warranty
 2. Network settings
 3. Riser diagrams from Shop drawings
 4. Training videos
 5. Flash drive with programing source code and software editing programs
 - b. Record Drawings
 - i. The Owner shall provide electronic (DWG) format of AV System system drawings that as-built construction information can be added to. These documents will be modified by the AV contractor to denote as-built information as defined above and returned to the Owner.

- ii. Provide a complete set of "as built" drawings in paper and electronic (DWG and PDF) formats showing cabinets, racks, patch panels, wiring, specific interconnections between all equipment and internal wiring of equipment. Drawings are to include all labeling information used in denoting equipment used in the installation. Labeling, icons, and drawing conventions used shall be consistent throughout all documentation provided.
 - 13. 28 1600 Intrusion Detection System
 - a. Record Drawings
 - i. A complete set of CAD "AS-BUILT" Drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of the system.
 - ii. A building map (2 copies) shall be supplied to the owner indicating the exact location of all devices along with the addresses of the individual devices. Install building security map adjacent to the security control panel. Provide high quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall be a clear center for viewing the CAD security drawing. Edges of the sign shall be colored to match the building interior. The building map shall indicate the various by the use of different colors (minimum of five colors).
 - iii. The USB flash drive containing the files shall be supplied to the owner. These shall include all information required to allow the district to change the security program themselves. The flash drive shall contain a minimum of the following:
 - 1. CAD drawing files of building security map.
 - 2. CAD drawing files of AS BUILT security components and point to point connections.
 - 3. General configuration programming.
 - 4. Job specific configuration programming.
 - 5. Tutorial file on complete programming of security system.
14. 28 2205 Access Control Systems
 - a. Manual Requirements
 - i. Manuals shall include all service, installation and programming information.
 - b. Record Drawings
 - i. A complete set of CAD "AS-BUILT" Drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon

- completion of the system.
- ii. A building map (2 copies) shall be supplied to the owner indicating the exact location of all devices along with the addresses of the individual devices. Install building security map adjacent to the security control panel. Provide high quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall be a clear center for viewing the CAD security drawing. Edges of the sign shall be colored to match the building interior.
 - iii. The USB flash drive containing the files shall be supplied to the owner. The flash drive shall include all information required to allow the district to change the security program themselves. The flash drive shall contain a minimum of the following:
 - 1. CAD drawing files of building security map.
 - 2. CAD drawing files of AS BUILT security components and point to point connections.
 - 3. General configuration programming.
 - 4. Job specific configuration programming.
 - 5. Tutorial file on complete programming of security system.
15. 28 2301 Video Surveillance System
- a. Record Drawings
 - i. A complete set of CAD “AS-BUILT” Drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of the system.
 - ii. A building map (2 copies) shall be supplied to the owner indicating the exact location of all devices along with the addresses of the individual devices. Install building security map adjacent to the security control panel. Provide high quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall be a clear center for viewing the CAD security drawing. Edges of the sign shall be colored to match the building interior.
 - iii. The USB flash drive containing the files shall be supplied to the owner. The flash drive shall include all information required to allow the district to change the security program themselves. The flash drive shall contain a minimum of the following:
 - 1. CAD drawing files of building security map.
 - 2. CAD drawing files of AS BUILT components and point to point connections.
 - 3. General configuration programming.

4. Job specific configuration programming.
 5. Tutorial file on complete programming of security system.
16. 28 3113 Fire Alarm and Detection System
- a. Manual Requirements
 - i. Operating and maintenance manuals shall be submitted prior to testing of the system. Manuals shall include all service, installation, and programming information.
 - b. Record Drawings
 - i. A complete set of CAD "as-built" drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of the system. Vendor shall not request drawings from the Engineer. Vendor shall request current architectural drawings from the Architect and include all cost with bid.
 - ii. A building map shall be supplied to the owner indicating the exact location of all devices along with the addresses of the individual devices. Install building fire alarm map adjacent to the fire alarm panel and all remote operating panels. Provide high quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall be a clear center for viewing the CAD fire alarm drawing. Edges of the sign shall be colored to match the building interior. The building map shall indicate the various devices and wiring by the use of different colors (minimum of five colors).
 - iii. Provide a DIGITAL COPY to the Owner containing the information specified below. The DIGITAL COPY shall include all information required to allow the Owner to change the fire alarm program themselves. The DIGITAL COPY shall contain a minimum of the following:
 1. CAD drawing files of building fire alarm map.
 2. CAD drawing files of as-built fire alarm components and point to point connections.
 3. General configuration programming.
 4. Job specific configuration programming.
 - c. Final Submittal to the Office of the Fire Marshal
 - i. Record of Completion: Provide a completed System Record of Completion (NFPA 72-Figure 4.5.2.1) in accordance with Section 4.5.3.
 - ii. Operation Instructions and A-Built Drawings: Provide one set of instructions on operation of the Fire Alarm System and one set of As-Built drawings. Demonstrate compliance of installation of the System Record Documents at or near the fire alarm control unit.

- iii. Fire Alarm Key Plan Drawing: Demonstrate compliance of installation of the fire alarm key plan drawing at the FACP.
- b. TUTORIAL FILE ON COMPLETE PROGRAMMING OF FIRE ALARM SYSTEM

END OF SECTION 26 0502

SECTION 26 0507 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-23 section making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical connections for equipment includes final electrical connection of all equipment having electrical requirements. Make final connections for all owner furnished equipment. See other applicable portions of specification for building temperature control wiring requirements.
- B. Refer to Division-23 sections for motor starters and controls furnished integrally with equipment; not work of this section.
- C. Refer to Division-23 section for control system wiring; not work of this section.
- D. Refer to sections of other Divisions for specific individual equipment power requirements.

1.3 QUALITY ASSURANCE:

- A. **NEC COMPLIANCE:** Comply with applicable portions of NEC as to type products used and installation of electrical power connections.
- B. **UL LABELS:** Provide electrical connection products and materials that have been UL-listed and labeled.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, raceways, conductors, cords, cord caps, wiring devices, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices, terminations, and connections as required. Crimp on or slip-on type splicing materials (insulation displacement type) designed to be used without wire stripping are not acceptable. See Section 26 0532, Conduit Raceways; Section 26 2726 Wiring Devices; and Section 26 0519 Conductors and Cables for additional requirements. Provide final connections for equipment consistent with the following:
 - 1. Permanently installed fixed equipment - flexible seal-tite conduit from branch circuit terminal equipment, or raceway; to equipment, control cabinet, terminal junction box or wiring terminals. Totally enclose all wiring in raceway.
 - 2. Movable and/or portable equipment - wiring device, cord cap, and multi-conductor cord suitable for the equipment and in accordance with NEC requirements (Article 400).
 - 3. Other methods as required by the National Electrical Code and/or as required by special equipment or field conditions.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS:

- A. Make electrical connections in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.
- B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams.
- C. Coordinate installation of electrical connections for equipment with equipment installation work.
- D. Verify all electrical loads (voltage, phase, horse power, full load amperes, number and point of connections, minimum circuit ampacity, etc.) for equipment furnished under other Divisions of this specification, by reviewing respective shop drawings furnished under each division. Meet with each subcontractor furnishing equipment requiring electrical service and review equipment electrical characteristics. Report any variances from electrical characteristics noted on the electrical drawings to Architect before proceeding with rough-work. In summary it is not in the Electrical Engineers scope to review the shop drawings from other trades/divisions.
- E. Interlock the exhaust fans of paint spray booths with the air spray equipment to prevent equipment from operating until exhaust fan is in operation.
- F. Obtain and review the equipment shop drawings to determine particular final connection requirements before rough-in begins for each equipment item.
- G. Refer to basic materials and methods Section 26 0553 Electrical Identification, Conductors, for identification of electrical power supply conductor terminations.

END OF SECTION 26 0507

SECTION 26 0519 - CONDUCTORS AND CABLES (600V AND BELOW)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to conductors and cables specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical conductor and electrical cable work is indicated by drawings and schedules.
- B. Types of conductors and cables in this section include the following:
 - 1. Copper Conductors (600V)
 - 2. Aluminum Conductor (600V)
 - 3. Fire Resistive Cables
 - 4. 0-10V Class 1 Circuits
- C. Applications for conductors and cables required for project include:
 - 1. Power Distribution
 - 2. Feeders
 - 3. Branch Circuits
 - 4. 0-10V Class 1 Circuits

1.3 RECORDS SUBMITTAL: Refer to Section 26 0502 for requirements.

1.4 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to construction and installation of electrical conductors and cable. Comply with UL standards and provide electrical conductors and cables that have been UL-listed and labeled.
- B. Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of conductors and cable.
- C. Comply with applicable portions of ANSI/ASTM and IEEE standards pertaining to construction of conductors and cable.

1.5 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 - PRODUCTS

2.1 COPPER AND ALUMINUM CONDUCTORS (600V):

- A. Provide factory-fabricated conductors of sizes, ratings, materials, and types indicated for each service. Where not indicated provide proper selection to comply with project's installation requirements and NEC standards. Provide conductors in accordance with the following:

1. Service Entrance Conductors – Copper/Aluminum conductor; see drawings for insulation type.
 2. Distribution and Panelboard Feeders; and Other Conductors, #2 AWG and Larger – Copper/Aluminum conductor; see drawings for insulation type.
 3. Branch Circuit Conductors and All Conductors #3 AWG and Smaller - Copper conductor, with THHN/THWN insulation. Size all conductors in accordance with NEC; minimum size to be #12 AWG.
 4. Aluminum Conductors. Where aluminum conductors are specified for use, provide compact stranded Aluminum Association 8000- series alloy conductor material.
 - a. [Stabiloy - Alcan Cable](#)
 - b. [Triple E - Southwire](#)
- B. Provide connectors and terminations for aluminum-alloy conductors of hydraulic compression type only, listed under UL 486-B, and marked "AL 7CU" for 75o rated circuits, and "AL9CU" for 90o rated circuits.
- C. Provide a maximum of three phase conductors in any one conduit or as approved by electrical engineer. Where phase conductors share a common neutral they must have a means to simultaneously disconnect all ungrounded conductors at the point where the branch circuits originate. The ungrounded and neutral conductors of a multi-wire branch circuit must be grouped together by wire ties at the point of origination.
- D. Provide neutral and ground wire as specified elsewhere in documents.
- E. Provide separate neutral conductor for all single phase branch circuits installed. No shared neutrals are allowed. Neutral conductor shall be the same size as the phase conductor.

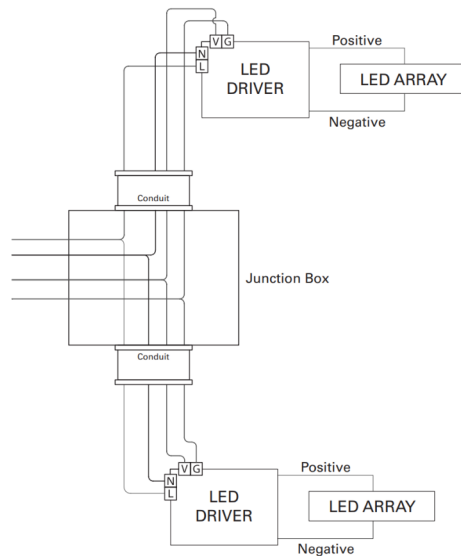
2.2 FIRE-RESISTIVE CABLE:

- A. Mineral Insulated Copper (MI) Copper Sheathed Cable:
1. General:
 - a. Provide 1/c type system 1850 sheathed power cable, conforming to current standards of UL system No. 1850.
 - b. Cable shall be classified as 2-hour fire resisting cable and shall comply with NEC articles 695 and 700 as an "Electrical Circuit Protective System" with a minimum 2-hour fire rating.
 - c. Construct cable with copper conductor with highly compressed magnesium oxide insulation and seamless soft-drawn copper sheath.
 - d. Provide termination kits as recommended by cable manufacturer.
 2. Manufacturer:
 - a. Subject to compliance with requirements, provide products of one of the following:
 - i. Pentair – Pyrotex System 1850

2.3 COPPER LOW VOLTAGE CONDUCTORS (0-10V CIRCUITS):

- A. 0-10V Class 1 Circuits:
1. General:

- a. Provide Class 1 circuits for all 0-10V dimming installations. Class 1 circuits shall be permitted to be installed with other circuits as specified in NEC 725.48 (A) and (B):
- i. Class 1 circuits shall be permitted to occupy the same cable, cable tray, enclosure, or raceway without regard to whether the individual circuits are alternating or direct current, provided all conductors are insulated for the maximum voltage of any conductors in the cable, cable tray, enclosure or raceway.
 - ii. Class 1 circuits shall be permitted to be installed with power supply conductors as specified:
 1. Class 1 and power supply circuits shall be permitted to occupy the same cable, enclosure, or raceway only when functionally associated.
 - iii. Utilize purple and grey copper conductors, with THHN/THWN insulation.



PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: Install electric conductors and cables as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standards of Installation", and in accordance with recognized industry practices.
- B. Coordinate installation work with electrical raceway and equipment installation work, as necessary for proper interface.
- C. Cables may be pulled by direct attachment to conductors or by use of basket weave pulling grip applied over cables. Attachment to pulling device shall be made through approved swivel connection. Nonmetallic jacketed cables of small size may be pulled directly by conductors by forming them into a loop that pull wires can be attached; remove insulation from conductors before forming the loop. Larger sizes of cable may be pulled by using basket weave pulling grip, provided the pulling force does not exceed limits recommended by manufacturer; if pulling more than one cable, bind them together with friction tape before applying the grip. For long pulls requiring heavy pulling force, use pulling eyes attached to conductors.

- D. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.008 lbs. per circular mil of conductor cross-section area.
 - E. Pull in cable from the end having the sharpest bend; i.e. bend shall be closest to reel. Keep pulling tension to minimum by liberal use of lubricant, and turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one in pullhole during this operation.
 - F. For training of cables, minimum bend radius to inner surface of cable shall be 12 times cable diameter.
 - G. Where cable is pulled under tension over sheaves, conduit bends, or other curved surfaces, make minimum bend radius 50% greater than specified above for training.
 - H. Use only wire and cable pulling compound recommended by the specific cable manufacturer, and that is listed by UL.
 - I. Seal all cable ends unless splicing is to be done immediately. Conduit bodies shall not contain splices.
 - J. Support all cables in pullholes, concrete trenches, and similar locations by cable racks and secure to rack insulators with nylon cord or self-locking nylon cable ties. Place each cable on separate insulator. In manholes, pullholes, concrete trenches, and similar locations, wrap strips of fire-proofing tape (approx. 1/16 inch thick by 3 inches wide) tightly around each cable spirally in half-lapped wrapping or in two butt-joined wrappings with the second wrapping covering the joints in the first. Apply tape with the coated side toward the cable, and extend tape one inch into the ducts. To prevent unraveling, random wrap the fireproofing tape the entire length of the fireproofing with pressure sensitive glass cloth tape. Provide fireproofing tape of a flexible, conformable fabric having one side coated with flame retardant, flexible, polymeric coating and/or a chlorinated elastomer not less than 0.050 inch thick weighing not less than 2.5 pounds per square yard. Provide tape that is noncorrosive to cable sheath, self-extinguishing, and that will not support combustion. Construct tape of materials that do not deteriorate when subjected to oil, water, gases, salt water, sewage and fungus.
 - K. Follow manufacturer's instructions for splicing and cable terminations.
 - L. Fire Protected Circuits:
 - 1. Provide protected circuits for emergency feeders for the following occupancies:
 - a. Educational occupancies with more than 300 occupants.
 - 2. Feeders shall be protected by one of the following. Electrical contractor shall be responsible for meeting one of the following methods:
 - a. Feeder is protected by a listed assembly with a minimum 2 hour fire rating.
 - b. Feeder is listed a fire-resistive cable assembly.
 - c. Feeder is encased in a minimum of 2" concrete.
- 3.2 AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW:
- A. Prior to energization, test cable and wire for continuity of circuitry, and for short circuits, Megger all circuits of 100 amp and greater rating. Correct malfunctions. Record all test data and provide written test report.
 - B. Subsequent to wire and cable connections, energize circuitry and demonstrate functioning in accordance with requirements.

3.3 IDENTIFICATION OF FEEDERS: Refer to Section 26 0553 for requirements.

END OF SECTION 26 0519

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SECTION 26 0526 – GROUNDING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Provide grounding as specified herein, and as indicated on drawings.
- B. Provide grounding and bonding of all electrical and communication apparatus, machinery, appliances, building components, and items required by the NEC to provide a permanent, continuous, low impedance, grounding system.
- C. Unless otherwise indicated, ground the complete electrical installation including the system neutral, metallic conduits and raceways, boxes, fittings, devices, cabinets, and equipment in accordance with all code requirements.
- D. Ground each separately derived system, as described in NEC Section 250-30, unless otherwise indicated.
- E. Types of grounding in this section include the following:
 - 1. Underground Metal Water Piping
 - 2. Metal Building Frames
 - 3. Grounding Electrodes
 - 4. Grounding Rods
 - 5. Reference Ground Buses
 - 6. Isolated Grounding Systems
 - 7. Separately Derived Systems
 - 8. Service Equipment
 - 9. Enclosures
 - 10. Systems
 - 11. Equipment
 - 12. Other items indicated on drawings
- F. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to electrical grounding and ground fault protection systems. Comply with applicable ANSI and IEEE requirements. Provide products that have been UL listed and labeled.
- B. Resistance from the service entrance ground bus, through the grounding electrode to earth, shall not exceed 5 ohms.

1.4 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 – PRODUCTS

2.1 MATERIALS AND COMPONENTS:

- A. GENERAL: Except as otherwise indicated, provide each electrical grounding system as specified herein, and as shown on drawings, including but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, and other items and accessories needed for complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.
- B. ELECTRICAL GROUNDING CONDUCTORS: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC. Provide with green insulation.
- C. GROUND RODS: Steel with copper welded exterior, 3/4" dia. x 10' long. Weaver or Cadweld.
- D. GROUND WELL BOXES FOR GROUND RODS: Precast concrete box 9-1/2" W. x 16" L. X 18" D. with light duty concrete cover for non-traffic areas or rated steel plate for traffic areas. Provide covers with lifting holes. Engrave cover with "GROUND ROD".
- E. CONCRETE ENCASED GROUNDING ELECTRODE (UFER GROUND): #2/0 AWG bare copper conductor.
- F. INSULATED GROUNDING BUSHINGS: Plated malleable iron body with 150 degree Centigrade molded plastic insulating throat, lay-in grounding lug with hardened stainless steel fasteners, OZ-Gedney BLG, or Thomas & Betts #TIGB series.
- G. CONNECTIONS TO PIPE: For cable to pipe, OZ-Gedney G-100B series or Thomas & Betts #390X series, or Burndy type GAR.
- H. CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES: For splicing and/or connecting conductors, use exothermic welds or high pressure compression type connectors. Provide exothermic weld kits manufactured by Cadweld or Thermoweld. If high compression type connectors are used for cable-to-cable, or cable-to-steel, or cable-to-ground rod connections, provide Thomas & Betts #53000 series, or Burndy Hyground series.
- I. BONDING JUMPERS: OZ-Gedney Type BJ, or Thomas & Betts #3840 series, or Burndy type GG and type B braid.
- J. MAIN BUILDING REFERENCE GROUND BUS: Provide one 18" L. X 2" H X 1/4" thick copper bus bar (or size noted on drawings). Mount on walls in locations shown, on insulating stand offs, 18" AFF. Furnish complete with lugs for connecting grounding system cables. All holes shall be drilled and tapped for single hole lugs. Provide 6 spare lugs and 6 lug spaces.
- K. INTERSYSTEM BONDING TERMINAL: Provide one 12" L. x 2" H x 1/4" thick copper bus bar. Mount on wall adjacent to Main Electrical Service Equipment on insulating standoffs, 18" A.F.F. Furnish complete with lugs for connecting systems grounding cables. All holes shall be drilled for 2 hole compression lugs. Provide 6 spare lugs. Connect to equipment grounding bus in Main Electrical Service Equipment with No. 4 AWG copper conductor.

PART 3 - EXECUTION

3.1 INSTALLATION OF GROUNDING SYSTEMS:

- A. Install electrical grounding systems in accordance with manufacturer's written instructions

and with recognized industry practices to ensure grounding devices comply with requirements.

- B. Install clamp-on connectors only on thoroughly cleaned and metal contact surfaces, to ensure electrical conductivity and circuit integrity.
- C. Provide grounding for the entire raceway, enclosure, equipment and device system in accordance with NEC. All non-metallic raceways shall include copper grounding conductor sized in accordance with NEC. Include copper grounding conductor in all raceway installed in suspended slabs.
- D. Provide service entrance grounding by means of ground rods (quantity of two, driven exterior to building), by means of bonding to water main, and by means of bonding to building structural steel. In addition, provide a grounding electrode (UFER) for not less than 30 lineal feet in concrete footing or foundation that is in direct contact with earth. Size electrode in accordance with NEC, but in no case, smaller than No. 4 AWG bare copper. Support electrode so as to be below finished grade near the bottom of the trench, and approximately three inches from the bottom or sides of the concrete. Locate a point of connection for inspection.
- E. Provide grounding conductors for dimming systems in accordance with manufacturer's requirement.

3.2 GROUNDING ELECTRODES:

- A. Concrete Encased Grounding Electrode (UFER Ground): Provide a #2/0 AWG minimum bare copper conductor encased along the bottom of concrete foundation or footings that are in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. Extend electrode through a horizontal length of 30 feet minimum and encase with not less than 2 nor more than 5 inches of concrete separating it from surrounding soils. At point of emergence from concrete, run electrode through a protective non-metallic sleeve and extend to the main building reference ground bus.
- B. Supplementary Grounding Electrode (Driven Rods): Provide driven ground rod(s) installed in listed ground well box(s) and filled with gravel after connection is made. Interconnect ground rod(s) with structural steel and adjacent rods with minimum #4 AWG bare copper conductor. Locate ground rod a minimum of 10 feet from any electrode of another electrical system or from adjacent ground rod(s).
- C. Separately Derived Electrical System Grounding Electrode: Ground each separately derived system per requirements in NEC Section 250-26 unless indicated otherwise.
- D. GROUNDING ELECTRODE CONDUCTOR: Provide grounding electrode conductor sized per NEC table 250-94 or as indicated.
- E. POWER SYSTEM GROUNDING: Connect the following items using NEC sized copper grounding conductors to lugs on the Main Building Ground Bus Service Ground Bus.
 - 1. Grounding electrode conductor from concrete encased electrode, and from ground rods, and from service entrance ground bus.
 - 2. Conductor from main incoming cold water piping system.
 - 3. Conductor from building structural steel.
 - 4. Ground for separately derived systems.
- F. Run main grounding conductors exposed or in metallic conduit if protection or concealment is required.
- G. EQUIPMENT BONDING/GROUNDING: Provide a NEC sized conductor, whether indicated or not on the drawings, in raceways as follows:

1. Non-metallic conduits and ducts.
 2. Distribution feeders.
 3. Motor and equipment branch circuits.
 4. Device and lighting branch circuits.
 5. Provide grounding bushings and bonding jumpers for all conduit terminating in reducing washers, concentric, eccentric or oversized knockouts at panelboards, cabinets and gutters.
- H. Provide bonding jumpers across expansion and deflection couplings in conduit runs, across pipe connections at water meters, and across dielectric couplings in metallic cold water piping system.
- I. Provide bonding wire in all flexible conduit.

3.3 TESTING:

- A. Obtain and record ground resistance measurements both from service entrance ground bus to the ground electrode and from the ground electrode to earth. Install additional bonding and grounding electrodes as required to comply with resistance limits specified under this Section.
- B. Include typewritten records of measured resistance values in the Operation and Maintenance Manual.
- C. Use independent testing agency for all testing.
- D. Use test equipment expressly designed for the purpose intended. Submit name of testing agency for review and approval, in writing, to the Engineer prior to the performance of any testing.

END OF SECTION 26 0526

SECTION 26 0529 - SUPPORTING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification section, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is a part of each Division-26, 27 and 28 section making reference to supports, anchors, sleeves, and seals, specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of supports, anchors, and sleeves is indicated by drawings and schedules and/or specified in other Division-26 sections. See Section 260532, Raceways, for additional requirements.
- B. Work of this section includes supports, anchors, sleeves and seals required for a complete raceway support system, including but not limited to: clevis hangers, riser clamps, C-clamps, beam clamps, one and two hole conduit straps, offset conduit clamps, expansion anchors, toggle bolts, threaded rods, U-channel strut systems, threaded rods and all associated accessories.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to construction and installation of electrical supporting devices. Comply with applicable requirements of ANSI/NEMA Std. Pub No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies". Provide electrical components that are UL-listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

A. GENERAL:

- 1. Provide supporting devices; complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified. See drawings for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

- A. Install hangers, anchors, sleeves, and seals as required, in accordance with manufacturer's written instructions and with recognized industry practices to ensure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports, clamps and attachments to support piping properly from building structures. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. For pre-and post tensioned

construction, use pre-set inserts for support of all electrical work. Do not use toggle bolts, moly bolts, wood plugs or screws in sheetrock or plaster as support for any equipment or raceway.

D. RACEWAYS:

1. Support raceways that are rigidly attached to structure at intervals not to exceed 8 feet on center, minimum of two straps per 10 foot length of raceway, and within 12" of each junction box, coupling, outlet or fitting. Support raceway at each 90° degree bend. Support raceway (as it is installed) in accordance with the following:

<u>NUMBER OF RUNS</u>	<u>3/4" TO 1-1/4" Ø</u>	<u>1-1/2" & LARGER Ø</u>
1	Full straps, clamps or hangers.	Hanger
2	Full straps, clamps or hangers.	Mounting Channel
3 or more	Mounting Channel	Mounting Channel

2. Support suspended raceways on trapeze hanger systems; or individually by means of threaded rod and straps, clamps, or hangers suitable for the application. Do not use "tie wire" as a portion of any raceway support system; do not support raceway from ceiling support wires.

E. CABLE SUPPORTS:

1. Install hangers, J-hooks, supports, clamps, clips, ties and attachments to support cables properly from building structures (red iron) at 10' intervals. Arrange for grouping of parallel runs of horizontal cables, in the red iron members to be supported together in bundles where possible. Do not use toggle bolts, moly bolts, wood plugs or screws in sheetrock or plaster as support for any cable run.

F. FLOOR MOUNTED EQUIPMENT:

1. Provide rigid attachment of all floor mounted equipment to the floor slab or structural system. Provide 5/8" bolts or expansion anchors at each 90 degree corner and at intervals not to exceed 48" on center along entire perimeter of the equipment. Provide rigid attachment for all floor mounted switchboards, panelboards, power and control equipment, motor control centers, dimmer cabinets, transformers (provide neoprene vibrations isolators at anchor points), oil switches, battery packs and racks, and similar equipment furnished under Division 26, 27 and 28.

G. WIREWAYS, BUS DUCTS AND CABLE TRAYS:

1. Provide vertical and lateral support systems for all wireways, busway, and cable trays that are supported from overhead structure. See Sections 260536 and 262500 for additional requirements.

END OF SECTION 26 0529

SECTION 26 0532 - CONDUIT RACEWAY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to electrical raceways and specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of raceways is indicated by drawings and schedules.
- B. Types of raceways in this section include the following:
 - 1. Electrical Metallic Tubing
 - 2. Flexible Metal Conduit
 - 3. Intermediate Metal Conduit
 - 4. Liquid-tight Flexible Metal Conduit
 - 5. Rigid Metal Conduit
 - 6. Rigid Non-metallic Conduit

1.3 QUALITY ASSURANCE:

- A. **MANUFACTURERS:** Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. **STANDARDS:** Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components that have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.
- C. **SUBMITTALS:** Refer to Section 26 0502 for requirements.

PART 2 – PRODUCTS

2.1 METAL CONDUIT AND TUBING:

- A. **GENERAL:**
 - 1. Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4".
- B. **RIGID METAL CONDUIT (RMC):** FS WW-C-0581 and ANSI C80.1.
- C. **INTERMEDIATE STEEL CONDUIT (IMC):** FS WW-C-581.
- D. **PVC EXTERNALLY COATED RIGID STEEL CONDUIT:** ANSI C80.1 and NEMA Std. Pub. No. RN 1.
- E. **ALUMINUM CONDUIT:** Not acceptable.
- F. **ELECTRICAL NON-METALLIC TUBING (ENT) SYSTEM:** Not acceptable.
- G. **MC CABLE:** Not acceptable, except for the following:

1. The use of MC-PCS cable is acceptable for light fixture whips utilizing 0-10v control schemes, not longer than 72" in length, located above removable grid ceilings. All MC cable shall be provided with anti-short fittings.
 - a. Acceptable Manufacturers
 - i. AFC – MC Luminary Cable
 - ii. Encore – MC-LED Lighting Cable
 - iii. Southwire – MC-PCS Duo
 - H. RIGID AND INTERMEDIATE STEEL CONDUIT FITTINGS:
 1. Provide fully threaded malleable steel couplings; raintight and concrete tight where required by application. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.
 - I. ELECTRICAL METALLIC TUBING (EMT): FS WW-C-563 and ANSI C80.3.
 - J. EMT FITTINGS:
 1. Provide insulated throat nylon bushings with non-indenter type malleable steel fittings at all conduit terminations. Install OZ Type B bushings on conduits 1" larger. Cast or indenter type fittings are not acceptable.
 - K. FLEXIBLE METAL CONDUIT: FS WW-C-566, of the following type;
 1. Zinc-coated steel.
 - L. FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 1, and Style A.
 - M. LIQUID TIGHT FLEXIBLE METAL CONDUIT:
 1. Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).
 - N. LIQUID-TIGHT FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 3, Style G.
 - O. EXPANSION FITTINGS: OZ Type AX, or equivalent to suit application.
- 2.2 NON-METALLIC CONDUIT AND DUCTS:
- A. GENERAL:
 1. Provide non-metallic conduit, ducts and fittings of types, sizes and weights as indicated; with minimum trade size of 3/4".
 - B. UNDERGROUND PVC PLASTIC UTILITIES DUCT:
 1. Minimum requirements shall be schedule 40 for encased burial in concrete and for Type II for direct burial.
 - C. PVC AND ABS PLASTIC UTILITIES DUCT FITTINGS:
 - D. ANSI/NEMA TC 9, match to duct type and material.
 - E. HDPE CONDUIT: Not acceptable.
- 2.3 CONDUIT; TUBING; AND DUCT ACCESSORIES:
- A. Provide conduit, tubing and duct accessories of types and sizes, and materials, complying with manufacturer's published product information, that mate and match conduit and tubing. Provide manufactured spacers in all duct bank runs.

2.4 SEALING BUSHINGS:

- A. Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ type CSB internal sealing bushings.

2.5 CABLE SUPPORTS:

- A. Provide OZ cable supports for vertical risers, type as required by application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS:

- A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and in accordance with the following:
 - 1. SERVICE ENTRANCE CONDUCTORS, AND CONDUCTORS OVER 600 VOLTS:
 - a. Install in rigid metal conduit (RMC), or intermediate metal conduit (IMC); except where buried below grade, install in non-metallic conduit or duct, individually encased in concrete. See duct banks.
 - 2. FEEDERS UNDER 600 VOLTS:
 - a. Install in electric metallic tubing (EMT). Below concrete slab-on-grade or in earth fill, install in non-metallic plastic conduit. In areas exposed to weather, moisture, or physical damage, install in RMC or IMC. In suspended slabs, install in EMT (NOT APPROVED). Encase non-metallic conduit 40-amps or more, 1-1/4" and larger and communication/data conduits 2" and larger in concrete. See duct banks.
 - 3. BRANCH CIRCUITS, SIGNAL AND CONTROL CIRCUITS, AND INDIVIDUAL EQUIPMENT CIRCUITS RATED LESS THAN 100 AMPS:
 - a. Install in electric metallic tubing (EMT). Below concrete slab-on-grade or in earth fill, install in non-metallic plastic duct. In areas exposed to weather, moisture, or physical damage, install in RMC or IMC. In suspended slabs, install in EMT (NOT APPROVED). Encase non-metallic conduit 40-amps or more, 1-1/4" and larger and communication/data conduits 2" and larger in concrete. See duct banks.
 - 4. UTILITY COMPANY COORDINATION:
 - a. For installation of conduits for Rocky Mountain Power (RMP) feeders provide Schedule 40 PVC with long radius sweep fiberglass elbows. Coordination RMP standards for trench width, depth and spacing from other utilities. Provide back fill material of sand, screened backfill, etc., acceptable to RMP or as specified elsewhere in these specifications, whichever is more stringent.
- B. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.
- C. Install raceway in accordance with the following:
 - 1. Provide a minimum of 12" clearance measured from outside of insulation from flues, steam and hot water piping, etc. Avoid installing raceways in immediate vicinity of boilers and similar heat emitting equipment. Conceal raceways in finished walls, ceilings and floor (other than slab-on-grade), except in mechanical, electrical and/or communication rooms, conceal all conduit and

connections to motors, equipment, and surface mounted cabinets unless exposed work is indicated on the drawings. Locate all conduits rising vertically through slab and exposed (ie. into panels) in concrete curbs as directed by the architect. Run concealed conduits in as direct a line as possible with gradual bends. Where conduit is exposed in mechanical spaces, etc., install parallel with or at right angles to building or room structural lines. Do not install lighting raceway until piping and duct work locations have been determined in order to avoid fixtures being obstructed by overhead equipment.

2. Do not install conduit horizontally in walls where it will intersect with water piping in the same vicinity.
 3. Do not install any conduits perpendicular to the structural trusses along the bottom cord of the truss. Installation to the bottom cord is only allowed when approved by the Owner/Architect and on top of the angle iron and parallel with the joist.
 4. The required raceway size, for any given installation, shall remain the same throughout the entire length of the run. At no point shall any conduit be reduced in size.
 5. Where cutting raceway is necessary, remove all inside and outside burrs; make cuts smooth and square with raceway. Paint all field threads (or portions of raceway where corrosion protection has been damaged) with primer and enamel finish coat to match adjacent raceway surface.
 6. Provide a minimum of 1 ½" from nearest surface of the roof decking to raceway.
 7. Provide a maximum of three phase conductors in any one conduit or as approved by electrical engineer.
 8. Provide neutral and ground wire as specified elsewhere in documents.
 9. Provide separate neutral conductor for all single phase branch circuits installed. No shared neutrals are allowed. Neutral conductor shall be the same size as the phase conductor.
- D. Comply with NEC for requirements for installation of pull boxes in long runs.
- E. Cap open ends of conduits and protect other raceways as required against accumulation of dirt and debris. Pull a mandrel and swab through all conduit before installing conductors. Install a 200 lb. nylon pull cord in each empty conduit run.
- F. Replace all crushed, wrinkled or deformed raceway before installing conductors.
- G. Do not use flame type devices as a heat application to bend PVC conduit. Use a heating device that supplies uniform heat over the entire area without scorching the conduit.
- H. Provide rigid metal conduit (RMC) for all bends greater than 22 degrees in buried conduit. Provide protective coating for RMC bend as specified herein.
- I. Where raceways penetrate building, area ways, manholes or vault walls and floors below grade, install rigid metal conduit (RMC) for a minimum distance of 10 feet on the exterior side of the floor or wall measured from interior face. Provide OZ, Type FSK, WSK or CSMI sealing bushings (with external membrane clamps as applicable) for all conduit penetrations entering walls or slabs below grade. Provide segmented type CSB internal sealing bushings in all raceways penetrating building walls and slabs below grade, and in all above grade raceway penetrations susceptible to moisture migration into building through raceway.
- J. Install liquid-tight flexible conduit for connection of motors, transformers, and other electrical equipment where subject to movement and vibration.
- K. Flexible metal conduit is only allowed for light fixture whips (maximum of 72") or in situations accepted by the Architect/Owner.

- L. Install spare 3/4" conduits (capped) from each branch panelboard into the ceiling and floor space. Run five into the ceiling space and five into the floor space. Where the floor is not accessible run six conduits into the ceiling space. Run conduits the required distance necessary to reach accessible ceiling space.
- M. Provide OZ expansion fittings on all conduits crossing building expansion joints, both in slab and suspended.
- N. Provide OZ cable supports in all vertical risers in accordance with NEC 300-19; type as required by application.
- O. Complete installation of electrical raceways before starting installation of cables/conductors within raceways.
- P. Raceway installation below grade:
 - 1. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020 inches). Completely wrap and tape all field joints.
 - 2. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.
 - 3. Install all conduits under concrete slab or in earth fill, embedded in sand with a minimum of 4" of cover around all conduits.
- Q. Raceway installation below slab-on-grade, or below grade:
 - 1. For slab-on-grade construction, install runs of rigid plastic conduit (PVC) below slab. All raceway shall be located a minimum of 8" below bottom of slab. Coordinate strictly with other trades at grade level structural members for correct installation. Install RMC (with protective coating) for raceways passing vertically through slab-on-grade. Slope raceways as required to drain away from electrical enclosures and to avoid collection of moisture in raceway low points.
 - 2. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020 inches). Completely wrap and tape all field joints.
 - 3. Mark all buried conduits that do not require concrete encasement by placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12" below final grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.
 - 4. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.
- R. Raceway installation in suspended slabs:
 - 1. No raceways are approved to be installed in suspended slabs.
- S. Raceway installation in hazardous locations:
 - 1. Install RMC in all hazardous locations as defined by NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with requirements.
 - 2. Engage at least five full threads on all fittings. Provide inspection fittings with explosion proof drains to prevent water accumulation in conduit runs. Install seal-offs for arcing or high temperature equipment, at housing with splices or taps and where conduits enter or leave the hazardous area. Provide seal-offs of the appropriate type for vertical or horizontal installation. Ground all metallic parts.
- T. DUCTBANKS:

1. Provide ductbank construction as indicated using 3000 psi at 28 day strength concrete. Use Type II low alkali per ASTM C150. Use ASTM C-33 aggregate gradation with maximum size of 3/4". Use W/C ratio of 0.50. Install #4 reinforcing bar per ASTM 615 grade 50 in each corner of ductbank. Provide minimum 4" concrete cover on all sides of exterior conduits. Provide polypropylene pull rope in all spare duct.
- U. Electrical Identification: Refer to Section 260553 for requirements.
- V. SPARE PARTS: Refer to Section 26 0502 for requirements.

END OF SECTION 26 0532

SECTION 26 0533 - ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is a part of each Division-26, 27 and 28 section making reference to electrical wiring boxes and fittings specified herein. See Section 260532, Raceways, for additional requirements.

1.2 DESCRIPTION OF WORK:

- A. The extent of electrical box and electrical fitting work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings in this section include the following:
 - 1. Outlet Boxes
 - 2. Junction Boxes
 - 3. Pull Boxes
 - 4. Floor Boxes
 - 5. Conduit Bodies
 - 6. Bushings
 - 7. Locknuts
 - 8. Knockout Closures
 - 9. Miscellaneous Boxes and Fittings

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to construction and installation of electrical boxes and fittings. Comply with ANSI C 134,1 (NEMA Standards Pub No. OS 1) as applicable to sheet-steel outlet boxes, device boxes, covers and box supports. Provide electrical boxes and fittings that have been UL-listed and labeled.

1.4 SUBMITTALS: Refer to Section 26 0503 for requirements.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

A. INTERIOR OUTLET BOXES:

- 1. Provide one piece, galvanized flat rolled sheet steel interior outlet wiring boxes with accessory rings, of types, shapes and sizes, including box depths, to suit each respective location and installation, construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box and covers and wiring devices; minimum size 4"x4"x2-1/8".
- 2. Provide an 'FS' box, with no knockouts when surface mounted in a finished, non-utility space. Surface mounting is only acceptable when approved by the Architect.

B. INTERIOR OUTLET BOX ACCESSORIES:

1. Provide outlet box accessories as required for each installation, including mounting brackets, hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, that are compatible with outlet boxes being used and fulfilling requirements of individual wiring applications.
- C. WEATHERPROOF OUTLET BOXES:
1. Provide corrosion-resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes (including depth) required, with threaded conduit ends, cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, with face plate gaskets and corrosion-resistant fasteners.
- D. JUNCTION AND PULL BOXES:
1. Provide code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- E. FLOOR BOXES:
1. Single Service Floor Box: Provide leveling and fully adjustable floor service receptacle outlets and fittings of types and ratings indicated; and with finish as selected by Architect. Equip with wiring devices as specified in Section 262726. Provide boxes compatible with floor system; provide epoxy-coated stamped steel boxes or cast iron boxes for slab-on-grade construction; provide stamped steel boxes for suspended slabs. Equip with tile and/or carpet flanges to accommodate floor finish material. Boxes shall be available in one, two or three gang configurations. Boxes shall comply with UL Standard UL514A.
 2. Multi-Service Floor Box: Provide leveling and fully adjustable multi compartment floor box; there shall be multiple independent wiring compartments; the floor box shall permit tunneling from end power compartment to end power compartment. Floor box shall accommodate a minimum of two duplex receptacles and two mounting plates for telecommunication devices. Equip with wiring devices as specified in Section 262726. Provide boxes compatible with floor system; with finish as selected by Architect. Provide epoxy-coated stamped steel boxes or cast-iron boxes for slab-on-grade construction; provide stamped steel boxes for suspended slabs. Equip with tile and/or carpet flanges to accommodate floor finish material. Boxes shall comply with UL Standards UL514A and/or UL514C.
 3. Manufacturer: subject to compliance with requirements, provide floor boxes of one of the following:
 - a. Harvey Hubbell, Inc.
 - b. Wiremold
- F. CONDUIT BODIES:
1. Provide galvanized cast-metal conduit bodies, of types, shapes and sizes to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.
- G. BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS:
1. Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and malleable steel conduit bushings and offset connectors, of types and sizes to suit respective uses and installation.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. GENERAL:

1. Install electrical boxes and fittings where indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
2. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.
3. Provide coverplates for all boxes. See Section 262726, Wiring Devices.
4. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.
5. Provide knockout closures to cap unused knockout holes where blanks have been removed.
6. Install boxes and conduit bodies to ensure ready accessibility of electrical wiring. Do not install boxes above ducts or behind equipment. Install recessed boxes with face of box or ring flush with adjacent surface. Seal between switch, receptacle and other outlet box openings and adjacent surfaces with plaster, grout, or similar suitable material.
7. Fasten boxes rigidly to substrates or structural surfaces, or solidly embed electrical boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum 10" of conduit between them. Set boxes on opposite sides of fire resistant walls with minimum of 24" separation.
8. Provide a minimum of 1 ½" from the nearest surface of the roof decking to the installed boxes.
9. Provide electrical connections for installed boxes.
10. Provide an approved fitting on each end of each conduit (regardless of voltage) whether in panel, box, etc. or in free air.
11. Install floor boxes as required for each specific installation per manufacturer installation instructions. Level box prior to concrete pour, to ensure flush mounting with floor (Including finish materials). Coordinate strictly with other trades and verify that the top of the cover assembly is absolutely flush with the floor finish material.

END OF SECTION 26 0533

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SECTION 26 0536 - RACEWAY SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 Section making reference to electrical raceways specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of raceways is indicated by drawings and schedules.
- B. Types of raceways in this section include the following:
 - 1. Overhead metal raceways
 - 2. Surface metal raceways
 - 3. Wire basket cable tray systems.

1.3 QUALITY ASSURANCE:

A. STANDARDS:

- 1. Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components that have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.
- 2. Comply with the following publications and standards for construction and installation or wire basket cable tray:
 - a. Comply with NEC Article 392
 - b. NEMA VE-1; NEMA VE-2-2001
 - c. NFPA 70B
 - d. ASTM B633; ASTM A653; ASTM A510

1.4 SUBMITTALS: Refer to Section 26 0503 for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED RACEWAY SYSTEMS:

A. GENERAL:

- 1. Provide electrical raceways of types, grades, sizes, weights [wall thicknesses], and number of channels, for each service indicated. Provide complete assembly of raceway including, but not necessarily limited to, couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, and other components and accessories as needed for complete system.

B. SURFACE METAL RACEWAYS:

- 1. Provide galvanized steel surface metal raceways of sizes and channels indicated. Provide fittings indicated that match and mate with raceway. Paint with

manufacturer's standard prime coating and finish color as indicated. Provide receptacles on centers as indicated on drawings or as directed by engineer.

2. MANUFACTURER:

- a. Subject to compliance with requirements, provide surface metal raceways of one of the following:
 - i. Wiremold Company
 - ii. Hubbell Incorporated

C. WIRE BASKET CABLE TRAY SYSTEMS:

1. MANUFACTURER:

- a. Subject to compliance with requirements, provide cable tray system of one of the following (OR APPROVED EQUAL):
 - i. Cooper B-Line Systems
 - ii. Cablofil, Inc.

2. Provide wire basket cable tray of types, grades, ratings, and sizes as specified and indicated meeting all requirements of NEMA VE-1. Provide complete assembly of raceway including, but not necessarily limited to, offsets, adapters, connector plates, splice plates, brackets, connector assemblies, holddown clamp assemblies, grounding clamps and other components and accessories as needed for complete system.

3. WIRE BASKET: Wire basket shall be made of high strength steel wires conforming to ASTM A510, and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. All wire ends along wire basket sides (flanges) shall be rounded during manufacturing for safety of cables and installers.

- a. All straight section longitudinal wires shall be straight, with no bends.
- b. Straight sections shall be furnished in standard 118 inch lengths.
- c. Wire basket shall have a 4 inch usable loading depth by 20 inches wide.
- d. Wire basket shall be electro-plated zinc in accordance with ASTM B633 SC2, with clear chromate sealer.
- e. Wire basket shall have a load capacity of 116 lbs per foot based on 5 foot spacing between supports.

4. BENDS: Horizontal and vertical bends, and horizontal tees shall be field formed. Inside radius of field bends shall be no less than 12 inches, and in no case smaller than required to comply with minimum radius requirement of cable manufacturer. Horizontal bends and tees shall be made such that the side rail of the tray is continuous with no gaps.

5. SPLICE ASSEMBLIES: Splice assemblies shall consist of splice plates and clamp/connectors furnished by the tray system manufacturer as standard components of the system. Splice assemblies shall be used to join separate horizontal sections together. Splice plates shall be approximately 2.7 inches long by 1.6 inches high, zinc-plated. Clamp/connectors shall be the bolted type consisting of welded stud plates with threaded studs and serrated flanged locknuts. Hardware shall be zinc-plated.

6. ACCESSORIES AND COMPONENTS: Support accessories shall be zinc-plated in accordance with ASTM B633 SC3. All threaded components shall be coated in accordance with ASTM B633 SC1.

7. Provide all fittings including connector plates, splice plates, clamps, supports, etc.

8. Grind all rough edges, drip concentrations, etc, to smooth finish. Apply cold zinc spray to all field cut surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS:

- A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and complying with recognized industry practices.
- B. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.
- C. Seal joints of underfloor ducts with sealing compound or tape prior to placing concrete.
- D. Level and square raceway runs, and install at proper elevations/heights.

3.2 ADJUSTING AND CLEANING:

- A. Upon completion of installation of raceways, inspect interiors of raceways; remove burrs, dirt and construction debris.

END OF SECTION 26 0536

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SECTION 26 0548 - ELECTRICAL SEISMIC CONTROL

PART 1 – GENERAL

1.1 WORK INCLUDED:

- A. Anchorage and seismic restraint systems for all Division 26 isolated and non-isolated equipment, cable tray, and conduit systems.
- B. Equipment/cable tray/conduit to isolated and/or seismically supported shall include but not be limited to the following:
 - 1. Conduit
 - 2. Cable Tray
 - 3. Light Fixtures
 - 4. Bus Duct
 - 5. Pad Mounted Equipment

1.2 RELATED WORK:

- A. Requirements: Provide Electrical Seismic Control in accordance with the Contract Documents.
- B. Section 260500 – Electrical General Provisions

1.3 REFERENCES:

- A. International Building Code, Current Edition in use by Jurisdictional Authority.
- B. NFPA Bulletin 90A, Current Edition.
- C. UL Standard 181.

1.4 SYSTEM DESCRIPTION

- A. The Division 26 Contractor shall be responsible for supplying and installing equipment, vibration isolators, flexible connections, rigid steel frames, anchors, inserts, hangers and attachments, supports, seismic snubbers and bracing to comply with the following:
 - 1. Short period design spectral response acceleration coefficient $SDS=0.70$.
 - 2. One second period design spectral response acceleration coefficient $SD1=0.28$.
 - 3. Site Class B.
 - 4. Seismic Design Category D.

1.5 QUALITY ASSURANCE:

- A. All supports, hangers, bases, anchorage and bracing for all isolated equipment and non-isolated equipment shall be designed by a professional engineer licensed in the state where the project is located, employed by the restraint manufacturer, qualified with seismic experience in bracing for electrical equipment. Shop drawings submitted for earthquake bracing and anchors shall bear the Engineer's signed professional seal. All calculations/design work required for the seismic anchorage and restraint of all Division 26 equipment and systems shall be provided by a single firm.
- B. The above qualified seismic engineer shall determine specific requirements for equipment anchorage and restraints, locations and sizes based on shop drawings for the electrical equipment that have been submitted, reviewed and accepted by the Architect/Engineer for this project.

- C. Seismic Engineer or the Engineer's Representative shall field inspect final installation and certify that bracing and anchorage are in conformance with the Seismic Engineer's design. A certificate of compliance bearing the Seismic Engineer's signed Professional Engineer's seal shall be submitted and shall be included in each copy of the Operation and Maintenance Manuals.
- D. The Division 26 Contractor shall require all equipment suppliers furnish equipment that meets the seismic code, with bases/skids/curb designed to receive seismic bracing and/or anchorage. All isolated and non-isolated electrical equipment bracing to be used in the project shall be designed from the Equipment Shop Drawings and certified correct by the equipment manufacturer for seismic description listed in Paragraph 1.4 above, with direct anchorage capability.

1.6 SUBMITTALS: Refer to Section 26 0503 for requirements.

PART 2 – PRODUCTS:

2.1 RESTRAINT EQUIPMENT AND SYSTEMS:

A. Acceptable Manufacturers and Suppliers for Non-Isolated Systems:

1. Mason Industries, Inc.
2. Korfund
3. Amber/Booth Company
4. Vibration Mountings and Control Company
5. Kinetics
6. International Seismic Application Technology
7. Tolco

B. Manufacture and design of restraints and anchors for isolated equipment shall be by the manufacturer of the vibration isolators furnished for the equipment.

2.2 SNUBBERS:

A. Snubbers shall be all-directional and consist of interlocking steel members restrained by replaceable shock absorbent elastomeric materials a minimum of 3/4 inch thick.

B. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch or more than 1/4 inch.

C. Snubbers shall be Mason Industries Z -1011 or accepted equivalent.

PART 3 – EXECUTION

3.1 DESIGN AND INSTALLATION:

A. General:

1. All electrical equipment cable tray and conduit shall be braced, anchored, snubbed or supported to withstand seismic disturbances in accordance with the criteria of this specification. Provide all engineering, labor, materials, and equipment for protection against seismic disturbances as specified herein. The following electrical components are exempt from seismic restraint requirements.
 - a. Components in Seismic Design Categories A and B (see 1.4 above).
 - b. Components in Seismic Design Category C (see 1.4 above) that have an important factor IP of 1.0 (see 1.4 above).

- c. Components that have an importance factor IP of 1.0 (see 1.4 above), that are mounted less than four feet above the floor, that weigh less than 400 pounds, and that have flexible ductwork, piping, and conduit connections.
 - d. Components that have an importance factor IP of 1.0 (see 1.4 above), that weigh 20 pounds or less, and that have flexible ductwork, piping, and conduit connections.
 2. Powder-actuated fasteners (shot pins) shall not be used for component anchorage in tension applications in Seismic Design Category D, E, or F.
 3. Attachments and supports for electrical equipment shall meet the following provisions:
 - a. Attachments and supports transferring seismic loads shall be constructed of materials suitable for the application and designed and constructed in accordance with a nationally recognized structural code such as, when constructed of steel, AISC, Manual of Steel Construction (Ref. 9.8-1 or 9.8-2).
 - b. Friction clips shall not be used for anchorage attachment.
 - c. Expansion anchors shall not be used for electrical equipment rated over 10 hp (7.45 kW). Exception: Undercut expansion anchors.
 - d. Drilled and grouted-in-place anchors for tensile load applications shall use either expansive cement or expansive epoxy grout.
 - e. Supports shall be specifically evaluated if weak-axis bending of light-gauge support steel is relied on for the seismic load path.
 - f. Components mounted on vibration isolation systems shall have a bumper restraint or snubber in each horizontal direction. The design force shall be taken as 2Fp. The intent is to prevent excessive movement and to avoid fracture of support springs and any non-ductile components of the isolators.
 - g. Seismic supports shall be constructed so that support engagement is maintained.
- B. Spring Isolated Equipment:
 1. All vibration isolated equipment shall be mounted on rigid steel frames or concrete bases as described in the vibration control specifications unless the equipment manufacturer certified direct attachment capability. Each spring mounted base shall have a minimum of four all-directional seismic snubbers that are double acting and located as close to the vibration isolators as possible to facilitate attachment both to the base and the structure. Snubbers shall be installed with factory set clearances.
- C. Non-Isolated Equipment:
 1. The section 260548 (Electrical Seismic Control) Contractor shall be responsible for thoroughly reviewing all drawings and specifications to determine all equipment i.e. switchboards, transformers, generators, etc. to be restrained. This Contractor shall be responsible for certifying that this equipment is mounted and braced such that it adheres to the system description criteria in part 1.04 of this specification section.
- D. Conduit:
 1. Seismic braces for conduit may be omitted when the distance from the top of the conduit to the supporting structure is 12" or less.

2. A rigid conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: Wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.
 3. Unbraced conduit attached to in-line equipment shall be provided with adequate flexibility to accommodate differential displacements.
 4. At the interface of adjacent structures or portions of the same structure that may move independently, utility lines shall be provided with adequate flexibility to accommodate the anticipated differential movement between the ground and the structure.
 5. Provide large enough pipe sleeves through wall or floors to allow for anticipated differential movements.
- E. Cable Tray:
1. Seismic restraints are not required for cable tray with importance factor IP of 1.0, provided that the following condition is met for the full length of each cable tray.
 - a. Cable trays are suspended from rod hangers and hangers that are 12" or less in length from the point rod attaches to tray, to the point rod connects to the supporting structure. Rods must be secured to both top and bottom cross angles with locking nuts above and below angle iron.

END OF SECTION 26 0548

SECTION 26 0553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Requirements of the following Division 26 Sections apply to this section:
 - 1. "Basic Electrical Requirements".
 - 2. "Basic Electrical Materials and Methods".

1.2 SUMMARY

- A. This section includes identification of electrical materials, equipment and installations. It includes requirements for electrical identification components including but not limited to the following:
 - 1. Buried electrical line warnings.
 - 2. Identification labels for raceways, cables and conductors.
 - 3. Operational instruction signs.
 - 4. Warning and caution signs.
 - 5. Equipment labels and signs.
 - 6. Arc-flash hazard labels
- B. Related Sections: The following sections contain requirements that relate to this section:
- C. Division 9 Section "Painting" for related identification requirements.
- D. Refer to other Division 26 sections for additional specific electrical identification associated with specific items.

1.3 QUALITY ASSURANCE

- A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code"

1.4 SUBMITTALS: Refer to Section 26 0503 for requirements.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. American Labelmark Co.
 - 2. Calpico, Inc.
 - 3. Cole-Flex Corp.
 - 4. Emed Co., Inc.
 - 5. George-Ingraham Corp.
 - 6. Ideal Industries, Inc.
 - 7. Kraftbilt

8. LEM Products, Inc.
9. Markal Corp
10. National Band and Tag Co.
11. Panduit Corp.
12. Radar Engineers Div., EPIC Corp.
13. Seton Name Plate Co.
14. Standard Signs, Inc.
15. W.H Brady, Co.

2.2 ELECTRICAL IDENTIFICATION PRODUCTS

- A. Colored Conduit Systems for raceway identification:
 1. Factory-painted conduit and/or factory-painted couplings and fittings
- B. Colored paint for raceway identification:
 1. Use [Kwal Paint](#) colors as specified in Part 3 – Execution.
- C. Color Adhesive Marking Tape for Raceways, Wires and Cables:
 1. Self-adhesive vinyl tape not less than 3 mills thick by 1" to 2" in width.
- D. Underground Line Detectable Marking Tape:
 1. Permanent, bright colored, continuous-printed, acid- and alkali-resistant plastic tape specifically compounded for direct-burial service. Not less than 6" wide by 4 mills thick.
 2. With metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep.
 3. Printed legend indicative of general type of underground line below.
- E. Wire/Cable Designation Tape Markers:
 1. Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with pre-printed numbers and letters.
- F. Brass or Aluminum Tags:
 1. Metal tags with stamped legend, punched for fastener.
 2. Dimensions: 2" X 2" 19 gage.
- G. Engraved, Plastic Laminated Labels, Signs and Instruction Plates:
 1. Engraving stock plastic laminate, 1/16" minimum thickness for signs up to 20 sq. in. or 8" in length; 1/8 " thick for larger sizes. Engraved legend in 1/4" high white letters on black face and punched for mechanical fasteners.
- H. Arc-flash Hazard Labels:
 1. ANSI Z535.4 Safety Label.
 2. Adhesive backed polyester with self-laminating flap. Chemical, abrasion and heat resistant.
 3. Dimensions: 5" x 3.5"
 4. Information contained: Arc-flash boundary; Voltage; Flash Hazard Category; Incident Energy (arc rating); checkboxes for the required Personal Protective Equipment (PPE) and the date that the calculations were performed.
- I. Equipment Labels:

1. Adhesive backed polyester with self-laminating flap. Chemical, abrasion and heat resistant.
2. Dimensions: minimum 5" x 2"
3. Conductor-Identification-Means Labels:
 - a. Information contained: the method utilized for identifying ungrounded conductors within switchboards, distribution panels and branch circuit panels.
4. Available-Fault-Current Labels:
 - a. Information contained: maximum available fault current at the respective piece of equipment, and date of calculation of fault current.
5. Source-of-Supply Labels:
 - a. Information contained: indicate the device or equipment where the power supply originates.
- J. Baked Enamel Warning and Caution Signs for Interior Use:
 1. Preprinted aluminum signs, punched for fasteners, with colors legend and size appropriate to location.
- K. Fasteners for Plastic-Laminated and Metal Signs:
 1. Self-tapping stainless steel screws or # 10/32 stainless steel machine screws with nuts, flat and lock washers.
- L. Cable Ties:
 1. Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18" minimum width, 50-lb. Minimum tensile strength, and suitable for a temperature range from minus 40° F. to 185° F. Provide ties for specified colors when used for color coding.
- M. Colored Support Wires:
 1. When electrical equipment/wiring is supported by wires within the ceiling cavity, these wires shall be independent of the ceiling support assembly and shall be distinguishable by painting entire length in bright yellow.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Lettering and Graphics:
 1. Coordinate names, abbreviations, colors and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering and colors as approved in submittals and as required by code.
- B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.
- C. Sequence of Work:
 1. Where identification is to be applied to surfaces that require a finish, install identification after completion of finish work.
- D. Conduit Identification:
 1. Identify Raceways of Certain Systems with Color Coding. Acceptable means of color identification are as follows:
 - a. Factory-painted conduit.

- b. Band exposed or accessible raceways of the following systems for identification. Bands shall be pre-tensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side. Install bands at changes in direction, at penetrations of walls and floors, and at 40-foot maximum intervals in straight runs. Apply the following colors:
 - i. Fire Alarm System: Red
 - ii. Sound/IC: Blue
 - iii. Data: Green
 - iv. MATV: Black
 - v. Security: Orange
 - vi. Legally Required Emergency Systems: Red with Black Stripe (Per NEC 700.10(A))
- 2. Identify Junction, Pull and Connection Boxes.
 - a. Code-required caution sign for boxes shall be pressured-sensitive, self-adhesive label indication system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers on outside of cover with identity of contained circuits. Use pressure-sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.
- 3. Label and paint the covers of the systems junction boxes as follows:

<u>SYSTEM</u>	<u>COLOR (ALL COLORS ARE KWAL PAINT)</u>	
Fire Alarm	Red Alert	AC118R
Sound/IC	Neon Blue	7076A
Telephone	Competition Yellow	7225A
Data	Java Green	AC098N
MATV	Flat Black	
Legally Required EM System	Red/Black Stripe	

- E. Underground Electrical Line Identification.
 - 1. During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground line detectable marking tape, located directly above line at 6 to 8 inches below finished grade. Where multiple lines are installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.
 - 2. Install detectable marking tape for all underground wiring, both direct-buried and in raceway.
 - 3. Provide red marker dye applied to concrete encased ductbank.
- F. Conductor Color Coding.
 - 1. Provide color coding for secondary service, feeder and branch circuit conductors throughout the project secondary electrical system as follows:

<u>CONDUCTOR</u>	<u>208Y / 120V System</u>	<u>480Y / 277V System</u>

Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Shared/Single Neutral	White	Gray
Neutral A (dedicated)	White w/Black Stripe	Gray w/Black Stripe
Neutral B (dedicated)	White w/Red Stripe	Gray w/Orange Stipe
Neutral C (dedicated)	White w/Blue Stripe	Gray w/Yellow Stipe
Equipment Ground	Green	Green
Isolated Ground	Green w/Yellow Strip	Green w/Yellow Stripe

2. Switch legs, travelers and other wiring for branch circuits shall be of colors other than those listed above.
3. Use conductors with color factory applied the entire length of the conductors except as follows:
 - a. The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
 - b. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
 - c. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

G. Power Circuit Identification.

1. Securely fasten identifying metal tags or aluminum wraparound marker bands to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms with 1/4-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-lb monofilament line or one-piece self-locking nylon cable ties.
2. Tag or label conductors as follows:
 - a. Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicting source and circuit numbers.
 - b. Multiple Circuits: Where multiple branch circuits or control wiring or communications/ signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by mean of coded color of conductor insulation. For control and communications/signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs,

- and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.
3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.
- H. Apply warning, caution and instruction signs and stencils as follows:
1. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items. Warning and caution signs shall be furnished and installed on, but not be limited to the following equipment and locations:
 - a. Entrances to rooms and other guarded locations that contain exposed live parts 600 volts or less; signs shall forbid unqualified personnel to enter.
 - b. Switch and Overcurrent device enclosures with splices, taps and feed-through conductors. Provide warning label on the enclosures that identifies the nearest disconnecting means for any feed-through conductors.
 - c. Entrances to buildings, vaults, rooms or enclosures containing exposed live parts or exposed conductors operating at over 600 volts: DANGER-HIGH VOLTAGE-KEEP OUT.
 - d. Metal-enclosed switchgear, unit substations, transformers, enclosures, pull boxes, connection boxes and similar equipment operating at over 600 volts shall have appropriate caution signs and warning labels.
 - e. Indoor and Outdoor substations operating over 600 volts. Provide warning signs, instructional signs and single-line diagrams in accordance with NEC 225.70.
- I. Emergency Operating Signs: Install engraved laminated signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
- J. Install equipment/system circuit/device identification as follows:
1. Apply equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/4"-high lettering on 1-inch-high label (1 1/2-inch-high where two lines are required) white lettering in black field. White lettering in red field for Emergency Power Systems. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment.
 - a. Each service disconnect, to identify it as a service disconnect.
 - b. Panelboards (exterior and interior), electrical cabinets, and enclosures. For subpanels, identify feeder circuit served from.
 - c. Switches in fusible panelboards shall be labeled. Main switches shall be identified.
 - d. Access doors and panels for concealed electrical items.

- e. Electrical switchgear and switchboards.
 - f. Motor starters, including circuit origination, HP, heater size, FLA, and mechanical equipment designation.
 - g. Disconnect switches.
 - h. Pushbutton stations.
 - i. Power transfer equipment.
 - j. Contactors.
 - k. Dimmers.
 - l. Control devices.
 - m. Transformers.
 - n. Power generating units, to include transfer switches.
 - o. Telephone switching equipment.
 - p. Clock/program master equipment.
 - q. Call system master station.
 - r. TV/audio monitoring master station.
 - s. Fire alarm master station or control panel.
 - t. Busduct – Label all cable tap boxes, bus plug-in units, etc. with plastic laminate labels designating load served.
 - u. Variable frequency drives.
 - v. Lighting Control Equipment.
 - w. Uninterruptable Power Supply.
- K. Post Conductor-Identification-Means labels at locations of switchboards, distribution panels and branch circuit panels. The labels shall identify the color-coding used on ungrounded conductors for each voltage system used on the premises.
- L. Apply Available-Fault-Current labels at the service entrance equipment.
- M. Apply Source-of-Supply labels on the exterior covers of equipment (except in single- or two-family dwellings) as follows:
- 1. Each switchboard supplied by a feeder.
 - 2. Each branch circuit panelboard supplied by a feeder.
 - 3. Each disconnect switch serving elevators, escalators, moving walks, chairlifts, platform lifts and dumbwaiters.
 - 4. Each dry type transformer (or primary-side disconnect switch at transformer). If the primary-side disconnect is remote from the transformer, both the remote disconnect and the transformer shall be labeled, and the transformer label shall also indicate the location of the disconnect.
 - 5. Each feeder disconnect, branch circuit disconnect, panelboard or switchboard in a remote building or structure.
 - 6. Each on-site emergency power source, with sign placed at service entrance equipment to comply with NEC 700.
- N. The label shall identify the device or equipment where the power supply originates, and the system voltage, phase or line and system at all termination, connection and splice points. For example: Feeder Power Supply for Panel “XX” Originates at Panel “XX” (or Switchboard “XX”, Transformer “XX”, Switch “XX”, etc.); 120/208 volts, 3-phase, Phase Color Identification (or 120/240, 277/480, etc.).
- O. Install Arc-flash hazard labels on the following equipment:

1. Each piece of service entrance equipment.
 2. Each power distribution switchboard or panel.
 3. Each individually mounted circuit breaker.
 4. Each branch circuit panelboard.
 5. Each motor control center.
 6. Each individually mounted motor starter.
 7. Each meter socket enclosure.
- P. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere.
- Q. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- R. Engrave all receptacle plates other than those serving 120 volt, single phase devices. State voltage and amperage characteristics: Example; "208V 30A".
- S. Mark each device box (for each type of wiring device) with a permanent ink felt tip marker, indicating the circuit that the device is connected to: Example; "CKT A-1"
- T. Label circuit breaker feeding fire alarm panel "Fire Alarm Circuit". Using plastic laminate label, white lettering on a red background.

END OF SECTION 26 0553

SECTION 26 0573 - PROTECTIVE DEVICE STUDY

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 work of this section.

1.2 DESCRIPTION OF WORK:

- A. Studies in this section include the following:
 1. Fault current protective device and equipment evaluation
 2. Protective device coordination study
 3. Arc-flash hazard analysis and study

1.3 QUALITY ASSURANCE:

- A. Provide protective device and arc-flash hazard studies performed by qualified engineers of the equipment manufacturer or an approved consultant. Studies must bear the professional engineer's stamp of the engineer in responsible charge of the protective device studies. Perform all work in accordance with latest IEEE and ANSI standards.

1.4 SUBMITTALS: Refer to Section 26 0503 for requirements.

PART 2 – STUDIES

2.1 FAULT CURRENT PROTECTIVE DEVICE & EQUIPMENT EVALUATION

- A. Perform fault current analysis with the aid of a computer and appropriate software. Include as input data the maximum available short circuit contribution, resistance and reactance components of the branch impedances, the X/R ratios, base quantities selected, and other source impedances.
- B. Coordination Criteria:
 1. All overcurrent protective devices serving the essential electrical system shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second. Provide overcurrent protection devices with larger frames sizes to ensure coordination has been achieved.
 2. Coordination shall not be required as follows:
 - a. Between transformer primary and secondary overcurrent protective devices, where only one overcurrent protective device or set of overcurrent protective devices exist on the transformer secondary.
 - b. Between overcurrent protective devices of the same size (ampere rating) in series.
- C. Calculate fault current close and latch duty values and interrupting duty values on the basis of assumed three-phase bolted short circuits at each switchgear bus, medium voltage controller, switchboard, low voltage motor control center, distribution panelboard, branch circuit panel and other significant locations throughout the system. Include symmetrical fault currents, and X/R ratios in the fault current tabulations. For each fault

location, list the total duty on the bus, as well as the individual contribution from each connected branch, with its respective X/R ratio. Calculate ground fault currents at each bus. Incorporate major motor contributions in determining momentary and interrupting ratings of protection devices.

- D. Perform an evaluation to determine the adequacy of circuit breakers, molded case switches, automatic transfer switches, and fuses, by tabulating and comparing the short circuit ratings of these devices with the calculated fault currents. Apply appropriate multiplying factors based on system X/R ratios and protective device rating standards. Report problem areas or inadequacies in the equipment due to short circuit currents prior to release for fabrication of switchgear, switchboards and/or appliance panelboard.

2.2 PROTECTIVE DEVICE COORDINATION STUDY

- A. Perform a protective device coordination study including the necessary calculations and logic decisions required to select power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage breaker trip characteristics and settings. Perform the studies in accordance with the latest applicable IEEE and ANSI standards.
- B. Include all medium and low voltage classes of equipment in the coordination study from the building or plant service protective devices down to and including the largest rated device in the low voltage motor control centers and panelboards. Include the phase and ground overcurrent protection as well as settings of all other adjustable protective devices.
- C. Develop time-current characteristics of the specified protective devices on log-log paper. Include complete titles, representative one-line diagram and legends, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves and fuses. Indicate on plots the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits and significant symmetrical and asymmetrical fault currents. Adhere to all restrictions of the National Electrical Code. Maintain proper coordination intervals and separation of characteristic curves.
- D. Provide coordination plots for phase and ground protective devices on a system basis. Provide a sufficient number of separate curves to clearly indicate the coordination achieved.
- E. Provide the selection and settings of the protective devices in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, manufacturer and type, range of adjustment and recommended settings. Provide a tabulation of the recommended power fuse selection for medium voltage fuses where applied in the system. Promptly report any discrepancies, problem areas, or inadequacies prior to release for fabrication of switchgear, switchboards and/or appliance panels.

2.3 ARC-FLASH HAZARD ANALYSIS AND STUDY

- A. Perform an arc-flash hazard analysis and study. Include the necessary calculations required to determine the level of Personal Protection Equipment (PPE) that a worker must use, the Arc Flash Boundary in inches, and the incident energy at each location. This information shall be calculated and determined for each piece of service entrance equipment, each power distribution switchboard or panel, each separately-mounted circuit breaker, each motor control center, each individually mounted motor starter, and for each branch circuit panelboard.
- B. Perform the analysis and study in accordance with IEEE 1584.

- C. Furnish and install a label at each piece of service equipment, each power distribution switchboard or panel, each separately mounted circuit breaker, each motor control center, each individually mounted motor starter, and each branch circuit panel board. The label shall be an ANSI approved Arc Flash Warning Label that warns and instructs workers of the arc flash hazard, voltage, arc flash boundary, and required PPE (Personal Protective Equipment).

2.4 ANALYSIS/REPORT

- A. Include the following in the report.
 - 1. Description, purpose, basis and scope of the study and a single line diagram of that portion of the power system that is included within the scope of the study.
 - 2. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties and commentary regarding same. Include formulas and description of methods used.
 - 3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
 - 4. Fault current calculations including a definition of terms and guide for interpretation of computer printout.
 - 5. Recommended size for power fuses and recommended settings for ground fault relays and for all adjustable trip relays, circuit breakers, etc.
 - 6. Tabulation of arc-flash calculations for each location and tabulation of arc-flash hazard, voltage, boundary and required PPE for each equipment item listed in the arc-flash analysis.

2.5 PROTECTIVE DEVICE TESTING, CALIBRATION AND ADJUSTMENT

- A. Provide the services of a qualified field engineer employed by the equipment manufacturer, and necessary tools and equipment to test, calibrate and adjust the protective relays, ground fault relays and circuit breaker trip devices as recommended in the Protective Device Study.
- B. Provide adjustments to circuit breakers and switchboard AIC ratings as deemed necessary by the analysis/report, with no additional cost to the Owner. Provide over current protection devices with larger frame sizes to ensure coordination has been achieved.

2.6 TYPEWRITTEN DEVICE SETTING TABULATION:

- A. Provide type written tabulation that includes all settings for each protective relay, ground fault relay and circuit breaker solid-state trip devices. Enclose the table in a protective plastic sleeve and affix to the main service entrance equipment.

END OF SECTION 26 0573

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SECTION 26 0923 - OCCUPANCY SENSORS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

- A. The extent of occupancy sensor work is indicated by drawings and schedules.
- B. Types of occupancy sensors in this section include the following:
 - 1. Dual Technology Wall Switch
 - 2. Dual Technology Wall Switch with Dimming and Daylight Control.
 - 3. Dual Technology Ceiling Sensor w/ Control Pack

1.3 QUALITY ASSURANCE:

- A. Comply with NEC and NEMA standards as applicable to construction and installation of occupancy sensors. Provide occupancy sensors that have been UL listed and labeled.
- B. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems, motor loads and any other passive infrared or microwave systems.

1.4 SUBMITTALS:

- A. Refer to Section 26 0502 for electrical submittal requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER: The manufacturer shall have a minimum of five years of experience in the sensor and lighting control industry. Sensors and related relays shall be compatible with the specific lighting types controlled. All sensors shall be of the same manufacturer, mixing brands of sensors is not acceptable.

- A. DUAL TECHNOLOGY WALL SWITCH: Where units are indicated provide a sensor that meets the following minimum requirements:
 - 1. Sensor shall utilize PIR (Passive Infrared) to turn on the lights and then PIR or US (Ultrasonic) technologies to keep lights on.
 - 2. Sensor shall incorporate an inrush current limiter circuit to protect the relay contacts.
 - 3. Sensor shall utilize single or dual dry relay contacts for control of the lighting loads. Contractor shall verify requirements in coordination with the drawings.
 - 4. Sensor shall have a self-adjusting time delay, selectable 5, 15 and 30 minutes.
 - 5. Sensor shall have automatic sensitivity adjustment and be microprocessor controlled.
 - 6. Sensor shall have light level sensing 0 to 200 footcandles.

7. Sensor shall have a 180 degree field of view, coverage up to 800 square feet and shall detect 6 inches of hand movement towards the sensor up to 300 square feet; and body motion towards the sensor up to 1000 square feet.
 8. Sensor shall be rated for 0 to 800 watts at 120VAC and 0 to 1200 watts at 277VAC.
 9. Sensor shall be automatic on and shall have an automatic to off override switch on the unit. Switch shall be equipped with an air gap switch to disconnect power to the lighting load.
 10. Sensor shall have real time motion indicator on the front of the unit.
 11. Sensor shall mount to a single gang switch box.
 12. Subject to compliance with the above requirements. Provide models of one of the following:
 - a. Douglas
 - b. Greengate ONW-D
 - c. Wattstopper
- B. DUAL TECHNOLOGY WALL SWITCH WITH DIMMING AND DAY-LIGHT CONTROL:**
Where units are indicated, provide a sensor that meets the following minimum requirements:
1. Dual technology sensors shall have one of its two technologies, not require motion to detect occupancy.
 2. Sensors shall offer a minimum on timer of at least 15 minutes, in order to prevent all cycling of lamps before they have burned for the lamp manufacturers minimum recommended time period.
 3. Sensors shall utilize an occupancy time delay that keeps lights on after last detected occupancy. Factory default setting of the occupancy time delay shall be 15 minutes.
 4. Manual adjustment to the occupancy time delay so as to increase it shall be accommodated.
 5. Sensor shall be capable of switching both 120 VAC and 277 VAC.
 6. Sensor shall recess into single gang switch box and fit standard GFI opening.
 7. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.
 8. Line and load wire connections shall be interchangeable.
 9. Wall switch sensor shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set-point.
 10. Sensor shall be capable of both auto-on and manual operation.
 11. Combination photocell/dimming sensors set point and deadband shall be automatically calibrated through the sensors microprocessor by initiating the automatic set point programming procedure. Min and max dim settings as well as

set point may be manually entered.

12. Subject to compliance with the above requirements, provide models of one of the following:
 - a. Douglas
 - b. Sensor-switch – N5X-PDT-D Series
 - c. Wattstopper – DW-311 (No Daylight Dimming, use when daylighting is not required)
- C. DUAL TECHNOLOGY CEILING SENSOR: Where units are indicated, provide a sensor that meets the following minimum requirements:
 1. Sensor shall incorporate ultrasonic (microphonics) and infrared technologies in a single unit.
 2. Sensor shall be Class 2, low voltage; capable of mounting in the ceiling for maximum coverage.
 3. Sensor shall use internal microprocessor for motion signal analysis and automatic self-adjustment.
 4. Sensor shall have automatic self-adjustment algorithm that adjusts timer and sensitivity settings to maximize performance and minimize energy usage.
 5. Sensor shall have manual time-out adjustment from 8 minutes to 32 minutes and automatic time out from 8 minutes to 100 minutes.
 6. Sensor shall have test time-out setting of 8 seconds, with automatic return to 8 minutes after one hour if sensor is left in test mode.
 7. Sensor's microprocessor shall automatically extend timer by 1 hour in response to recognition to false off condition. After 5 hours, sensor reduces extended time by 30 minutes and continues to reduce by 30 minute increments over the next few days.
 8. Sensor's microprocessor shall automatically reduce either PIR or ultrasonic sensitivity in response to false on condition.
 9. Sensor microprocessor will automatically monitor PIR background threshold signal level and makes corresponding sensitivity adjustments automatically.
 10. Sensor microprocessor algorithm shall incorporate automatic adaptation to continuous airflow.
 11. For airflow that is so intense as to mask motion, sensor shall flash indicator LED code to indicate excessive airflow.
 12. Sensor's microprocessor shall use a four week learning period and develop a circadian calendar.
 13. An internal 24 hour 7 day clock establishes what periods the room is typically occupied, biasing sensor to keep lights on while normally occupied and off when normally unoccupied.
 14. Sensor shall have selection settings for the following dual technology schemes:
 - a. High Sensitivity and High Confidence (miser mode)
 15. Sensor shall be available with either 180 degrees or 360 degrees coverage pattern.
 16. Infrared lens shall have 360 degree field of view. Two types of lens shall be available, standard and extra dense.

17. Sensor shall have a variety of mask inserts for PIR coverage rejection to prevent false tripping.
 18. Transducers shall be protected from tampering.
 19. Sensor shall have manual adjustments for timer and sensitivities and override switches to force manual adjustment mode.
 20. Sensor shall have adjustable sensitivity from 0% to 100% for both ultrasonic and infrared.
 21. Controls shall be behind cover to resist tampering. All adjustments shall be accessible from the front of the sensor.
 22. Sensor shall be available with a photocell adjustment from 20 to 3,000 Lux.
 23. Sensor shall provide internal operating status and settings confirmation via LED motion lamp indicator.
 24. Sensor shall have two (if 180 degree) or three (if 360 degree) real time LED motion indicators visible from the front of the unit: Red = infrared; green = ultrasonic.
 25. Subject to compliance with the above requirements, provide models of one of the following:
 - a. Douglas
 - b. Hubbell-ATD Series
 - c. Sensor Switch-CM-PDT Series
 - d. Wattstopper-DT Series
 - e. Mytech-Omni-DT Series
 - f. Lithonia - LMTO Series
 - g. Leviton – OSC UOW Series
 - h. Greengate OMC – DT Series
- D. 24 VDC POWER/CONTROL PACK: Where units are indicated, provide a power/control pack that meets the following minimum requirements:
1. Control module shall consist of a DC power supply and a dry contact relay for switching a lighting load.
 2. Control module shall consist of a DC power supply and a dry contact relay for HVAC control.
 3. Control module shall be available in versions to accept 120, and 277 VAC line voltages.
 4. Output shall be 24VDC nominal, and shall be inherently safe, low voltage, limited power output (Class 2).
 5. Output shall supply 100mA current, in addition to current consumed internally to operate internal relay.
 6. Relay shall utilize normally open, silver alloy dry contacts, and shall be rated for a 20A ballast load at 120V and 277V.
 7. Relay function shall not require more than 5 mA control current to operate.
 8. Control module shall have line voltage wiring, consisting of input voltage and relay contact connections, exiting from one end, and low voltage DC connections, consisting of ground, power, and control wires, exiting from the other end.
 9. Control module shall be sized to fit inside a standard 4" x 4" junction box.

10. Control module shall be equipped with a 1/2" EMT threaded male fitting on the line voltage end, such that it may be mounted to the outside of a junction box with the line voltage wiring internal to the box and the low voltage wiring external.
11. Control module shall be equipable with accessory 1/2" EMT threaded male fitting on the low voltage end, such that it may be mounted to the inside of a ballast cavity with the box and line voltage wiring internal to the cavity and the low voltage wiring external.
12. Slave module shall be available for switching additional circuits. Slave module has same construction and specifications as control module except without power supply function.
13. Subject to compliance with the above requirements, provide models of one of the following:
 - a. Douglas
 - b. Hubbell-CU Series
 - c. Sensor Switch-PP-20 Series
 - d. Wattstopper-BEP Series
 - e. Mytech-MP Series
 - f. Lithonia - LPCS Series
 - g. Greengate SP20-MV Series
 - h. Leviton – OSC/OSA Series

PART 3 – EXECUTION

3.1 INSTALLATION OF LIGHTING CONTROL EQUIPMENT:

- A. Install occupancy lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements.
- B. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.
- C. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.
- D. Contractor shall be on site as required, to adjust lighting control units for proper operation.
- E. Mount the switchpack in a standard 4" junction box. Mount sensor to a standard 4" junction boxes. Refer to manufacturer supplied mounting instructions.
- F. All lighting programming shall meet the requirements of the IECC 2018 or current energy code applied to the project.

3.2 FIELD QUALITY CONTROL:

- A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements.
- B. System start-up: Provide a factory authorized technician to verify the installation and test the system.
- C. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

- D. Contractor shall visit the job site 3 months after the owner has taken occupancy and adjust any units not operating properly, otherwise remove and replace with new units.

3.3 PRODUCT SUPPORT AND SERVICES:

- A. System Start-Up: Provide a factory authorized technician to verify the installation, test the system, and train the owner on proper operation and maintenance of the system. Before requesting start-up services, the installing contractor shall verify that:
 - 1. The sensors have been fully installed in accordance with manufacturer's installation instructions.
 - 2. Low voltage wiring for overrides and sensors is completed.
 - 3. Accurate 'as-built' load schedules have been prepared.
 - 4. Proper notification of the impending start-up has been provided to the owner's representative.
 - 5. Programming of all switches, sensors, power packs, relays, etc. shall be completed by factory authorized technician, prior to final and training.
- B. Factory support: Factory telephone support shall be available at no cost to the owner during the warranty period. Factory assistance shall consist of assistance in solving programming or other application issues pertaining to the control equipment. The factory shall provide a toll free number for technical support.
- C. Functional Testing:
 - 1. The owner shall hire a third party that will conduct and certify the functional testing.
 - 2. Lighting controls devices shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working conditions in accordance with the construction documents, manufacturer's instructions and code requirements. The following shall be performed:
 - a. Certify that sensors have been located, aimed and calibrated per manufacturer recommendations.
 - b. Status indicator operates properly.
 - c. Fixtures that are controlled by auto-on controls turn on to permitted level.
 - d. Fixtures that are controlled by manual on controls operate when manually activated.
 - e. Fixtures do not turn on incorrectly due to HVAC or movement outside the controlled area.
 - f. Confirm that occupancy sensors turn off after space is vacated and do not turn on unless space is occupied.
 - g. Simulate unoccupied conditions and confirm that vacancy sensors only turn on manually and turn off after space is vacated.
 - 3. The party responsible for the functional testing shall provide documentation that the installed lighting controls meet or exceed all performance criteria and shall not be directly involved in the design or construction of the project.

3.4 WARRANTY:

- A. Manufacturer shall provide a one (1) year limited warranty on lighting control system. A ten (10) year limited warranty shall be provided on the lighting control relays.

3.5 RECORD DRAWINGS:

- A. Refer to Section 26 0502 for electrical Record Drawings Requirements (Following Lighting Controls).

3.6 MANUFACTURER AUTHORIZED PERSONNEL TRAINING:

- A. Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating lighting control system equipment.

END OF SECTION 26 0923

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SECTION 26 0943 - LIGHTING CONTROL EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Provide a lighting control system, including all system components, wiring, and any ancillary equipment necessary for a complete and working system. The system shall include all necessary components to achieve control and monitoring of all lighting fixtures, supporting both relay-switched and dimmed lighting solutions and controlled receptacles.
- B. Electrical drawings show general zoning intent and lighting control narrative.
- C. Energy Code: The system shall comply with latest edition of IECC energy code.
- D. Types of lighting control equipment specified in this section, includes the following:
 - 1. Low voltage relay control panels
 - 2. Occupancy sensors
 - 3. Daylight sensors
 - 4. Wallstations/Switches
 - 5. Lighting Load Controllers (Room Controllers)
 - 6. Emergency Lighting Control Units/Generator Transfer Devices
- E. Requirements are indicated elsewhere in these specifications for work including but not limited to raceways, electrical boxes and fittings required for installation of lighting control equipment, not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years. To ensure a uniform installation and single responsibility, all switching and dimming equipment described herein shall be supplied by a single manufacturer.
- B. Installer: Qualified with at least 3 years of successful installation experience on projects with lighting control equipment installation work similar to that required for project.
- C. NEC Compliance: The control system shall comply with all applicable National Electrical Codes regarding electrical wiring standards.
- D. NEMA Compliance: The control system shall comply with all applicable portions of the NEMA Standard regarding the types of electrical equipment enclosure.

- E. Codes and Standards: Provide units that meet the requirements of IEEE Std. 2000.1.1999.
- F. Independent Testing Laboratory: Provide units that have been tested and listed under UL 916 energy management equipment.
- G. Component Pre-testing: All control equipment shall undergo strict inspection standards. The equipment shall be previously tested and burned-in at the factory prior to installation.

1.4 SUBMITTALS:

- A. Refer to Section 26 0502 for electrical submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide lighting control equipment of one of the following;
 - 1. Hubbell Building Automation
 - 2. Lutron Lighting Controls
 - 3. Leviton Lighting Controls
- B. The lighting controls as shown are based upon Hubbell lighting controls. Prior approval and commitment to being able to provide similar and equal system is required before bidding this project. Any system different from Cooper Controls that requires additional relays, etc. not shown on plans due to lack of separation of relays and dimming zones must be accounted for and provided in the bid and must function as similar to that which is required in final installation.
- C. Manufacturer's representative for division 26 and bidding controls shall be accountable for the comprehensive lighting controls package's finalization in alignment with the design intent depicted in the drawings and complying with IECC 2021 requirements. The lighting representative is required to develop detailed shop drawings demonstrating the lighting control system's topology and the essential connections necessary for its proper functioning. Lighting control devices shown are to provide general intent only. Manufacturer representatives to provide all additional devices and modify device locations as required to meet IECC 2021 requirements

2.2 SYSTEM DESCRIPTION:

- A. The lighting control system shall provide seamless control and monitoring of all lighting included in the scope of work regardless of whether it is relay switched or dimmed.
- B. The lighting control system shall consist of low voltage relay control panels with programmable switch inputs, the panel shall be microprocessor controlled with a touchscreen interface display. The touchscreen shall provide relay status information viewable through a protected windowed enclosure. All local programming shall be permissible through the self-prompting touchscreen.
- C. Programmable intelligence shall include:
 - 1. Time of day control (64 time-of-day/holiday schedules)
 - 2. 32 holiday dates
 - 3. Timed inputs (adjustable from 1 to 99 minutes)

4. Timed override (from touchscreen, adjustable from 1 to 999 minutes, then resumes normal schedule)
 5. Pre-set controls
 6. Auto daylight savings adjust
 7. Low voltage Dimming/Central Dimming Controls:
 - a. 0-10V dimming capability
 - b. Daylighting control via 0-10V dimming relays and programming
 - c. DMX or other dimming protocols as indicated on plans
 8. Astronomical clock with offsets
 9. Local control (from touchscreen and local switch)
 10. Digital wallstations/switches
 11. Flash warning of impending off for occupants
 12. Network override
- D. The controller shall permit lighting to be overridden on for after-hours use or cleaning. The controller shall provide priority and masking choices to allow for customizing the functions of switch inputs, thereby enabling wallstations/switches to function differently at different times of day. These overrides shall be digital, network or hard-wired inputs.
- E. The lighting control system shall be fully programmable through PC programming software. Programming shall be permitted through a direct RS-232 connection, modem or TCP/IP.
1. Shall include with user-friendly software suitable for operation on computer workstations which serve as central control stations for the selection and operation of lighting scenes.
 2. All software shall be programed by the vendor and delivered ready to use. This program shall include preparation of all graphics, and displays required as a part of this project.
- F. The control system shall provide networking between lighting control panels. The network shall support up to a maximum of 254 control panels. Panels shall permit data sharing for global controls. All inputs shall be transferable over the network to create any switching pattern.
- G. The lighting control system shall log all control events. Log reports shall be available through the integral touchscreen or enterprise software.
- H. All lighting programing shall meet the requirements of the IECC 2021 or current energy code applied to the project.

2.3 EQUIPMENT:

- A. Relay Panel
1. Enclosure: Shall be NEMA 1 rated, code gauge steel cabinet. Enclosure and contents shall be designed to operate in interior spaces with temperatures of 32°F - 104°F (0°-40°C) and 0-90% non-condensing humidity. Enclosure shall be available with optional recessed mounting hardware. See drawings for mounting requirements and refer to schedules on drawings for sizes.
 2. Interior: Interiors shall be sized to accept relays and will provide true on/off

indication of relay status through LED's. The system shall employ all modular connectors to avoid repeat wiring in case of component failure. The system CPU board shall be mounted on quick release hinge pins. All connections for the dry contact inputs shall incorporate modular connectors.

3. Power Supply: The control panel shall incorporate the use of a multi-tapped transformer. The panel shall not require specification of voltage for each control location. The voltage of 120 and 277 VAC shall be available with each control panel.
4. Cover: Provide surface cover with captive screws in hinged, lockable configuration. A wiring schedule directory card shall be affixed to the covers back to allow identification of circuits/relays/load controlled. Schedules must be typed and related to final room names and numbers (not bid document room names and numbers).
5. High Voltage Barrier: The controller shall provide the ability to provide for either voltage separation or emergency circuit separation.
6. Relays: The system shall utilize normally open control relays, that are rated to 20A at 120/277 VAC. The relays shall be mechanically latching, and shall permit individual override and LED configuration of relay status. The relays shall be rated for 10 million operations.
7. System Controller: The system controller shall consist of an integral touchscreen that provides access to the main programming features. The touchscreen shall permit the user to manually command any or all relays individually.
 - a. Provide master on/off control of a relay group while still allowing individual relays to be overridden by their local switch.
 - b. The control system shall permit up to 32 dry contact inputs for override purposes. Momentary 3 wire or 2 wire (toggle) inputs shall be supported. Any input shall be software linked to any number or relays.
 - c. The controller shall provide timers for each override. Each override timer shall be capable of 0-999 minutes. Software shall enable or disable overrides based on priorities, masks or time of day scheduling.
 - d. The controller shall accept either dry contact or analog ambient light sensors. The controller shall provide power for the sensor. Sensors shall provide for outdoor, indoor or skylight applications and issue a command to the controller once the threshold is reached.
 - e. Each control panel shall incorporate diagnostic aids for confirmation of proper operation. The control panel shall employ both a backlit touchscreen and LED's to indicate:
 - i. Power
 - ii. System OK
 - iii. Network communications
 - iv. System clock and date
 - v. Programming confirmation
 - vi. Control panel subnet network communications
8. Emergency Relay Panels: Shall work in accordance with all governing codes and compliances and all local codes having jurisdiction. Emergency Relay panels shall operate as normal powered relay panels during normal non-emergency power conditions. In case of emergency or power outage emergency designated panels shall work independently and provide automatic and maintained full on power, illumination and control functioning to all designated egress luminaires throughout the building and project site.

9. Wallstations/Switches/Plates: The lighting controller shall support digitally addressable LED annunciated switches. Provide low voltage push-button switches in up to 6 button configurations. Provide factory engraved labeling for individual push-buttons. Provide in color to match wiring devices and coverplate to match devices and plates in Wiring Devices (Section 26 2726).
10. Photocells:
 - a. Provide a photocontrol point that consists of an architecturally compatible sensor mounted in the appropriate location for measuring the available daylighting. Each sensor will have a separate calibration module mounted in an enclosure in the electrical closet.
 - i. Exterior Lighting: Provide a hooded sensor that can be horizontally mounted on a ½" KO or threaded conduit. The unit shall employ a flat lens and work with a foot-candle range between 1-10 or 10-100 in 10% increments.
 - b. Control Unit shall allow for either direct control of up to three devices. These devices can be a relay, or any other device which allows control by a three wire momentary contact.
 - c. Control unit shall be switchable between four foot-candle measurement ranges (1- 10 FC, 10- 100 FC, 100- 1000 FC and 1000- 10,000 FC). Depending upon the sensor head and application.
 - d. Control unit shall have separate trip points for the high and low response settings. These settings shall be entered via dial switches. LED's shall be provided to illustrate whether the sensor is below the 'low' setting, above the 'high' setting, or in the deadband range.
 - e. Control unit shall allow for a momentary contact device to override the photocell relays to either an on or off state.
 - f. Control unit shall employ a 3-minute time delay between switching outputs to avoid nuisance tripping. It shall be possible to disable the time delay to aid in initial setup and trouble shooting.
 - g. Sensor devices shall be available to match application. Each sensor shall employ photodiode technology to allow a linear response to daylight in its given foot-candle range:
11. Low Voltage Dimming (0-10V):
 - a. Capable of controlling any 0-10V source with the required dimming channels.
 - b. 0-10V analog voltage signal.
 - c. Provide isolated 0-10V output signal conforming to IEC 60929.
 - d. Sink current via IEC 60929.
 - e. Source current.
12. Indoor Lighting: Provide a sensor with a Fresnel lens providing for a 60° cone shape response area. The unit shall work with a range between 10-100 foot-candles.
13. Skylights: Provide a daylight sensor with a translucent dome with a 180° field of

view and respond in the range of 1,000

14. Wallstations: Provide low voltage push-button type switches up to 8 button configurations to match requirements of lighting control within the room. Provide factory engraved labeling for individual push buttons. Provide in a color to match wiring devices and coverplates to match devices and plates in Wiring Devices (Section 26 2726). Wallstation shall connect to the room controller via the room controller local network. Wallstations that require user interface to allow for raise/lower control of dimming, loads shall include a slider function or similar. All wallstations shall have the ability to be independently program or be re-programmed on site and without the need to replace or send the device to the manufacturer for re-programming.
15. Wiring:
 - a. Provide manufacturer approved 18/2 AWG solid cabling (Dataline) with a topology free, polarity free wiring arrangement to connect lighting control devices.
 - i. All dialog system cabling shall be white or gray.
 - b. Provide Dataline cabling between centralized relay panel controller and other necessary building controllers via Dialog Network Dataline. The Dialog Network Dataline allows a maximum single wiring run of 1000ft and a total aggregated length of 3000ft from all datalines originating from an LCU located in the Master Panel CLCP. Provide standard School Network drop at the main CLCP for connection to the Global Web Server.
 - i. Classrooms to be independent and not connected to the centralized system.
 - c. Programming: Provide a RS-232 (RJ-R Connection) to allow programming through either a local connection or remotely through a modem.
 - d. Provide wiring in conduit located within the walls and non-accessible ceilings. Provide wiring above accessible ceilings in conduit to system enclosure to system enclosure.
16. **Systems Communicating & BACnet IP;**
 - a. **Enterprise Software: Provide a PC based interface software that provide access to the lighting control system files within a Windows® environment. The software shall allow individual or network panel programming to be executed locally, via direct connection or remotely through a TCP/IP connection or modem.**
 - b. **Ethernet Interface Module: Provide access to the control panels over a TCP/IP connection by converting sent information into RS-232 communication capable information.**
 - c. **Automation Interface Module to district wide BMS: The control panel shall provide for data protocol translation and permit systems that utilize the Modbus® N2, BACnet or LonWorks communication protocols to operate individual relays or relay groups.**
 - d. **Provide programming and training time to properly integrate into the Owner's BMS system. Program system per the owner's requirement. Train owner so as to allow them to have the ability to make changes to the system in the future.**

B. Room Controllers:

1. The room controller shall provide the following functionality;
 - a. Provide interface with room occupancy sensor to provide lighting and receptacle control and be programmable as either manual on/automatic off. Provide interface with room wallstations to provide multi-level switching and/or variable dimming. Provide interface with daylight sensors to provide daylighting controls of lighting fixture via multi-level (step dimming) and/or variable dimming.
2. The room controller shall be a fully functional lighting control system to match the room lighting and control requirements. The controller shall provide the following features:
 - a. Separate compartments for line voltage, emergency voltage and low voltage connections.
 - b. Breakouts for direct conduit connections.
 - c. Dual voltage (120/277 VAC)
 - d. Low voltage connections using standard RJ-45 connectors.
 - e. Zero cross circuitry for each load.
 - f. Relay and 0-10V dimming zone configuration to match room requirements.
 - g. The ability to be independently program or be re-programmed on site and without the need to replace or send the device to the manufacturer for re-programming.
3. Emergency Lighting: When the room controller is provided with emergency relay, the controller shall be UL 924 Listed and monitor the normal power circuit. The UL 924 relay will track the normal power operation. Upon loss of normal power the emergency lighting will be forced on to full bright (if dimming) until normal power is restored. The following features shall be included:
 - a. 120/277 VAC
 - b. Push-to-test
4. Daylight sensors shall work with the room controller to provide automatic daylight dimming capabilities for loads connected to the room controller. The daylight sensor shall include the following features:
 - a. An additional photodiode that measures only the visible spectrum.
 - b. The sensor shall have three light level ranges;
 - i. Low (3-300 LUX), high (30-3000 LUX) and direct sun (300-30,000 LUX).
 - c. The sensor shall provide the capability of controlling multiple (up to three) daylight zones for dimming daylight harvesting.
 - d. The sensor shall include an internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.
5. Ceiling Mounted Occupancy Sensors: Sensors shall utilize dual-technology (ultrasonic and infrared technologies) and have the following additional features:
 - a. Sensor shall be class 2, low voltage; capable of mounting in the ceiling for maximum coverage.
 - b. Sensor shall have automatic self-adjustment algorithm that adjusts timer and sensitivity settings to maximize performance and minimize energy usage.
 - c. Sensor shall have 360 degree field of view.

- d. Sensor shall incorporate non-volatile memory such that all settings and parameters are saved in protected memory.
 - e. Sensor shall have time delays from 10 to 30 minutes.
 - f. Sensor shall provide a visual means of indication that motion is being detected via an LED.
 - g. Sensors shall have readily accessible, user adjustable settings for time delay and sensitivity.
 - h. Provide internal additional isolated relay with NO, NC and common outputs for use with HVAC control, data logging and other control options.
6. Wallstations: Provide low voltage push-button type switches up to 8 button configurations to match requirements of lighting control within the room. Provide factory engraved labeling for individual push buttons. Provide in a color to match wiring devices and coverplates to match devices and plates in Wiring Devices (Section 26 2726). Wallstation shall connect to the room controller via the room controller local network. Wallstations that require user interface to allow for raise/lower control of dimming, loads shall include a slider function or similar. All wallstations shall have the ability to be independently program or be re-programmed on site and without the need to replace or send the device to the manufacturer for re-programming.
- C. Emergency Power Control (CEPC)/ Emergency Lighting Control Units (ELCU)/Generator Transfer Devices (Required when not built into Room Controller, Relay Panel, etc):
1. The Emergency Power Control (CEPC)/Lighting Control Unit (ELCU) shall provide all required functionality to allow any standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building. The unit shall be installed flush to the ceiling so that test switch & LED's are in plain view of room occupants as required by some local electrical codes.
 2. The device shall automatically illuminate connected emergency loads upon utility power interruption, regardless of room switch position. (NEC 700.24)
 3. Local room switch or lighting control shall turn both regular & emergency luminaires on at the same time (no dedicated emergency room switch required).
 4. The emergency lighting control unit shall allow control of emergency lighting fixtures in tandem with normal lighting in an area while ensuring that emergency lighting will turn on immediately to full brightness upon loss of normal power supplying the control device. Emergency lighting operation shall be independent for each controlled area and shall not require a generalized power failure for proper operation.
 5. The unit shall be compatible with 2-wire, 3-wire, 0-10V, & DALI dimming systems & ballasts.
 6. The device shall be self-contained, measure 1.70" x 2.97" x 1.64," and provide integral one half inch pip nipple mount with snap in locking feature for mounting into a standard junction box KO.

7. The device shall have normally closed dry contacts capable of switching 20 amp emergency ballast loads @ 120-277 VAC, 60 Hz, or 10 amp tungsten loads @ 120 VAC, 60 Hz.
 8. The device shall have universal rated voltage inputs provided for normal power sense and normal switched power at 120-277 VAC, 60 Hz.
 9. The device shall have an integral momentary test switch. Pressing and holding this switch shall instantly force the unit into emergency mode and turn on emergency lighting. Releasing the test switch shall immediately return the unit to normal operation.
 10. The unit shall provide dedicated leads and 24 VDC source for connection to remote test switch, fire alarm system, or other external system capable of providing a normally closed dry contact closure. Breaking contact between the terminals shall force and hold the emergency lighting on until the terminals are again closed. An integral LED indicator shall indicate the unit's current remote activation status.
 11. The device shall provide separate LEDs to indicate the presence of normal and emergency power sources. The LEDs shall indicate the unit's current operational mode (normal or emergency).
 12. The device's normal power input lead shall be connected to the line side of the control device such that any upstream fault causing a loss of power, including the tripping of the branch circuit breaker, will force the unit into the emergency mode and turn on the emergency lighting.
 13. The unit shall automatically switch emergency lighting on and off as normal lighting is switched. When normal power is not available, the unit shall force and hold emergency lighting on regardless of the state of any external control device until normal power is restored.
 14. The unit shall utilize zero crossing circuitry to protect relay contacts from the damaging effects of inrush current generated by switching electronic ballast loads.
 15. The unit shall have UL 94-V0 or UL 94-5VA flame rating & be approved for installation above the suspended ceiling.
 16. To ensure quality and reliability, the unit shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
 17. The device shall not generate any objectionable electrical or mechanical noise.
 18. The unit shall be UL and cUL listed and labeled for connection to both normal and emergency lighting power sources.
- D. Interface and Accessories (Classroom Solatubes Controller Interface):

1. Provide serial data interface that connects to the room controllers local network to a third-party system for coordinated control of devices including lighting controls, solatube controls and user interfaces by either system.
 - a. Provide manufacturer capable communication devices capable of communicating via standard protocols – RS-232, RS-485 and Ethernet (Preferred Method).
2. Program shades, per owner's requirements, to operate in accordance with the defined lighting presets within the space.

PART 3 - EXECUTION:

3.1 INSTALLATION OF LIGHTING CONTROL EQUIPMENT:

- A. Install lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturers written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements.
- B. Comply with Requirements of NEC, and applicable portions of NECA's 'Standard of Installation' pertaining to general electrical installation practices.
- C. Coordinate with other electrical work, including raceways, electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.
- D. Electrical Identification: Refer to Section 26 0553 for requirements.

3.2 FIELD QUALITY CONTROL:

- A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements.
- B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

3.3 PRODUCT SUPPORT AND SERVICES:

- A. System Start-Up: Provide a factory authorized technician to verify the installation, test the system, and train the owner on proper operation and maintenance of the system. Before requesting start-up services, the installing contractor shall verify that:
 1. The control system has been fully installed in accordance with manufacturer's installation instructions.
 2. Low voltage wiring for overrides and sensors is completed.
 3. Accurate 'as-built' load schedules have been prepared for each lighting control panel.
 4. Proper notification of the impending start-up has been provided to the owner's representative.
 5. Programming of all wallstations/switches, relays, groups of relays and interfaces with building automation shall be completed by factory authorized technician, prior to final and training.
- B. Factory support: Factory telephone support shall be available at no cost to the owner

during the warranty period. Factory assistance shall consist of assistance in solving programming or other application issues pertaining to the control equipment. The factory shall provide a toll free number for technical support.

3.4 PROGRAMMING:

- A. Program of all lighting control systems as directed by the electrical engineer and/or owner. Meet with the electrical engineer at their office prior to preparation of shop drawings to discuss specific programming and zoning requirements of system(s). Each networked or standalone system shall be programmed to revert back to its normal “ON” position one hour after selecting a scene or raising or lowering a lighting zone.
- B. All lighting programming shall meet the requirements of the IECC 2021 or current energy code applied to the project.
- C. Integrate lighting controls into classroom or room AV touch Screen and Shade Controller. Provide interface as required. Coordinate with AV integrator to integrate with Touch Panel and GUI within the room. Lighting shall provide multiple presets and slider control options.
 - 1. Sensors can be used to trigger automated settings for shades and projector screens based on room occupancy, ambient light level, etc.
 - 2. Program lighting and shades, per owner’s requirements, to operate in accordance with the defined lighting presets within the space.

3.5 COMMISSIONING:

- A. A lighting control system requires at least one site visit for proper commissioning. If multiple site visits are required, the first ensures that the contractor is trained to install the system correctly. On the second, the factory trained engineer will start up the system, ensure that it is operating according to specification, and perform initial programming. The third visit is for the purposes of refining the programming, and training the owner/end user on the system.
- B. Provide factory-certified field service engineer to ensure proper system installation and operation under following parameters:
 - 1. Certified by the equipment manufacturer on the system installed.
 - 2. Site visit activities:
 - a. Verify connection of power feeds and load circuits.
 - b. Verify connection of controls.
 - c. Verify system operation control by control, circuit by circuit.
 - d. Obtain sign-off on system functions.
 - e. Demonstrate system capabilities, operation and maintenance and educate Owner’s representative on the foregoing.
 - 3. At least three site visits to accomplish the following tasks:

- a. Prior to wiring:
 - i. Review and provide installer with instructions to correct any errors in the following areas:
 - 1. Low voltage wiring requirements
 - 2. Separation of high and low voltage wiring runs
 - 3. Wire labeling
 - 4. Load schedule information
 - 5. Switching cabinet locations and installation
 - 6. Physical locations and network addresses of controls
 - 7. Ethernet connectivity
 - 8. Computer-to-network connections
 - 9. Load circuit wiring
 - 10. Connections to other systems and equipment
 - 11. Placement and adjustment of Occupancy Sensors
 - 12. Placement and adjustment of Photocells
- b. After system installation:
 - i. Check and approve or provide correction instructions on the following:
 - 1. Connections of power feeds and load circuits
 - 2. Connections and locations of controls
 - 3. Connections of low voltage inputs
 - 4. Connections of the data network
 - ii. Turn on system control processor and upload any pre-programmed system configuration
 - iii. Verify cabinet address(es)
 - iv. Upload pre-programmed system configuration and information to switching and/or dimming cabinets
 - v. Check load currents and remove bypass jumpers

- vi. Verify that each system control is operating to specification
 - vii. Verify that each system circuit is operational according to specification
 - viii. Verify that manufacturers' interfacing equipment is operating to specification
 - ix. Verify that any computers and software supplied by the manufacturer are performing to specifications
 - x. Verify that any remote WAN (Wide Area Network) connections are operating properly
 - xi. Have an owner's representative sign off on the above-listed system functions
- c. Before project completion and hand-off:
- i. Demonstrate system capabilities and functions to owner's representative
 - ii. Train owner's representative on the proper operation, adjustment, and maintenance of the system.
- C. Notification: Upon completion of the installation, the contractor shall notify the manufacturer that the system is ready for formal checkout. Notification shall be given in writing a minimum of 21 days prior to the time factory-trained personnel are required on site. Each field installed RJ45 connection must be tested prior to system interconnection. A test report must be furnished to manufacturer prior to scheduling commissioning activity. Manufacturer shall have the option to waive formal turn-on.
- D. Turn-On: Upon completion of all line, load and interconnection wiring, and after all fixtures are installed and lamped, Manufacturer's Certified Technician shall completely check the installation prior to energizing the system. Each installed relay system shall be tested for proper ON/OFF operations, and proper LED illumination. Each installed control cabinet shall be tested verifying that each controlled load adjusts to the selected setting and that all switch LED's illuminate properly.
- E. Provide written commissioning report including space/room names and numbers indicating list of all lighting equipment and devices tested and verifying proper operation of the system. Report shall include corrections, programming information/file, warranties, and owner's representative sign off on the above-listed system functions.
- F. At the time of checkout and testing, the owner's representative shall be thoroughly instructed in the proper operation of the system.

3.6 RETRO-COMMISSIONING:

- A. During the one year warranty period, provide retro-commissioning services at three month, six month, nine month, and one year marks. Provide at least 4 hours of commissioning service for each of the four retro-commissioning periods. This will include meeting with the Owner to receive feedback on the system and making changes to the system including programming, task tuning.

3.7 MAINTENANCE:

- A. Enable the end user to order new equipment for system expansion, replacements, and spare parts.
- B. Make new replacement parts available for a minimum of ten years from the date of manufacture.
- C. Manufacturing shall provide telephone technical support by factory personnel 24 hours a day, 7 days a week. Project cost overruns and delays can occur without this service. Answering services can add to frustration and delay the resolution of any problems or issues. Manufacturers who do not offer factory-direct technical support on a 24/7 basis should not be acceptable on this project.
- D. Provide factory-direct technical support hotline 24 hours per day, 7 days per week.
- E. Offer renewable annual service contracts, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system commissioning.

3.8 WARRANTY:

- A. Manufacturer shall provide a one (1) year limited warranty on lighting control system. A ten (10) year limited warranty shall be provided on the lighting control relays.

3.9 RECORD DRAWINGS:

- A. Refer to Section 26 0502 for electrical O & M requirements.

3.10 TRAINING:

- A. Provide four (4) hours of recorded training in two 2 hour sessions on the operation and use of the lighting control equipment, at job site, at no cost to the Owner.
- B. Provide a USB Flash device to the owner containing the information specified below. The media shall include all information required to allow the Owner to change the schedules themselves. The media shall contain a minimum of following:
 - 1. CAD drawing files of 'as-built' lighting control components and point to point connections.
 - 2. General configuration programming.
 - 3. Job specific configuration programming to include schedule.
- C. Tutorial file on complete programming of lighting control system

END OF SECTION 26 0943

SECTION 26 1010 - ENERGY & POWER METERING SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and methods sections apply to work of this section except as otherwise indicated. See Section 26 2713 Service Entrance, Section 26 2413 Switchgear and Switchboards, and Section 26 2416 Panelboards.

1.2 DESCRIPTION OF WORK:

- A. Provide equipment to measure, monitor, acquire and store electrical metering data, and to communicate energy and power data to the building BAS/BMS (Building Automation System/Building Management System). Communication of data to the BAS/BMS system shall use the BACnet protocol.
- B. System shall include, but not be limited to, electronic primary meters and sub-meters, meter/monitor devices, current and voltage transformers as required, microprocessors, communications network, communications modules and network equipment, and all ancillary equipment to provide a complete and operating Energy and Power Metering System.
- C. System shall measure kWh energy use, kW power, power factor, frequency, voltage and current data, and shall store and communicate this data separately for the following individual load categories: Total HVAC System; Interior Lighting; Exterior Lighting; Plug Loads; Process Load; and Building Operations and Other Miscellaneous Loads.

TABLE C405.12.2
ENERGY USE CATEGORIES

LOAD CATEGORY	DESCRIPTION OF ENERGY USE
Total HVAC system	Heating, cooling and ventilation, including but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120-volt equipment, or by 208/120-volt equipment that is located in a building where the main service is 480/277-volt power, is permitted to be excluded from total HVAC system energy use.
Interior lighting	Lighting systems located within the building.
Exterior lighting	Lighting systems located on the building site but not within the building.
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets.
Process load	Any single load that is not included in an HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building, including but not limited to data centers, manufacturing equipment and commercial kitchens.
Building operations and other miscellaneous loads	The remaining loads not included elsewhere in this table, including but not limited to vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas and snow-melt systems.

- D. System shall also comply with 2021 IECC C405.12 Energy Monitoring Measurement Requirements and Energy Monitoring Credit 406.10.

- E. System shall store all meter data for at least 36 months.
- F. PRIMARY METERING: Primary metering equipment shall be utility-grade equipment. Functions provided by the Energy and Power Metering System equipment and components in this section include the following:
 - 1. Data acquisition, data storage and communication to the the building BAS/BMS system
 - 2. Overall building electrical energy use data in kWh stored and communicated to the BAS/BMS at 15-minute intervals
 - 3. Overall building electrical power demand data in kW stored and communicated to the BAS/BMS at 15-minute intervals
 - 4. Overall building electrical power factor data stored and communicated to the BAS/BMS at 15-minute intervals.
 - 5. Building voltage data stored and communicated to the BAS/BMS at 15-minute intervals
 - 6. Building current data in amperes stored and communicated to the BAS/BMS at 15-minute intervals
- G. SUBMETERING: Submetering equipment shall be revenue-grade equipment. Functions provided by the Energy and Power Metering System equipment and components in this section include the following:
 - 1. Total HVAC System equipment electrical energy in kWh, power demand in kW, voltage and current data stored and communicated to the BAS/BMS at 15-minute intervals
 - 2. Interior Lighting energy in kWh, power demand in kW, voltage and current data stored and communicated to the BAS/BMS at 15-minute intervals
 - 3. Exterior Lighting energy in kWh, power demand in kW, voltage and current data stored and communicated to the BAS/BMS at 15-minute intervals
 - 4. Plug Load energy in kWh, power demand in kW, voltage and current data stored and communicated to the BAS/BMS at 15-minute intervals
 - 5. Process Load energy in kWh, power demand in kW, voltage and current data stored and communicated to the BAS/BMS at 15-minute intervals
 - 6. Building Operations and Other Miscellaneous Loads energy in kWh, power demand in kW, voltage and current data stored and communicated to the BAS/BMS at 15-minute intervals
- H. Any additional equipment and accessories required for a fully functional metering system to meet the intent of the specifications shall be provided whether or not specifically listed herein.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable pertaining to construction and installation of electrical/electronic metering systems and equipment.
- B. Comply with applicable requirements of UL safety standards pertaining to electrical/electronic metering systems and equipment. Provide equipment that has been UL listed and labeled.
- C. All work shall be done by expert technicians qualified in the field with knowledge of metering systems and experience installing similar systems.
- D. The manufacturer's qualified technician shall calibrate, test and adjust the metering system

and make all final connections to the metering equipment

1.4 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. The acceptable manufacturers listed below shall provide Energy and Power Metering System equipment and install the necessary equipment within their electrical switchboards and panelboards.
- B. Subject to compliance with requirements, provide products of one of the following:
 - 1. Leviton Manufacturing Co. Inc. (Basis of Design)
 - 2. Cutler-Hammer Products, Eaton Corp.
 - 3. General Electric Co.
 - 4. Siemens Energy & Automation, Inc.
 - 5. Square D Co.

2.2 EQUIPMENT AND COMPONENTS:

- A. GENERAL: Energy and Power Metering system:
 - 1. Shall measure, meter, record and store electrical energy and power data.
 - 2. Shall automatically communicate electrical energy and power data.
 - 3. The system shall utilize multiple submeters and power monitor devices throughout the electrical distribution system, located in multiple switchboards and panelboards that serve lighting, plugloads, hvac equipment and laboratories. The system shall acquire and store energy and power data from the primary meter and from each of the submeters/power monitor devices over a network, with the result that the data shall be centralized in the Central Energy & Power Display/Processor. The Central Energy & Power Display/Process shall communicate the data to the BAS/BMS systems.
 - 4. All set-up parameters shall be stored in non-volatile memory and retained in the event of a control power failure.
- B. PRIMARY METER equipment shall be a utility-grade device, located within manufacturer's switchboard. Meter equipment monitor devices shall:
 - 1. be designed for use with current inputs from standard instrument current transformers.
 - 2. shall measure line-to-line voltage each phase, line-to-neutral voltage each phase, line current each phase, frequency, power in kW of each phase (and total), apparent power each phase (and total).
 - 3. shall calculate line-to-line average 3-phase voltage, average current, total power demand in kW, power factor, and accumulated energy in kWh.
- C. SUBMETER equipment shall be revenue-grade devices, located within manufacturer's switchboards and panelboards. Meter equipment monitor devices shall:
 - 1. be designed for use with integral current sensors or external current transformers

2. shall measure line-to-line voltage each phase, line-to-neutral voltage each phase, line current each phase, frequency, power in kW of each phase (and total), apparent power each phase (and total).
 3. shall calculate line-to-line average 3-phase voltage, average current, total power demand in kW and accumulated energy in kWh.
- D. POWER MONITOR DEVICES:
1. similar to Leviton "Leviton VerifEye Metering System"
 2. integral built-in current transformers up to 400 amperes
 3. monitors watts, watt-hours, watt demand, currents, voltages, frequency, reactive power, apparent power factor and displacement power factor
- E. CURRENT TRANSFORMERS:
1. Solid-core transformers, with ratings corresponding to the feeder breaker current rating.
 2. plus or minus 2% accuracy
 3. UL listed
- F. CENTRAL ENERGY & POWER DISPLAY/PROCESSOR:
1. Microprocessor-based.
 2. Shall acquire and store energy and power data from primary meter, submeters and power monitor devices.
 3. Shall communicate data to the BAS/BMS. Shall report data at 15-minute intervals as specified and described in paragraphs 1.2.F and 1.2.G.
 4. Shall store all metering data for at least 36 months.
 5. Shall report hourly, daily, monthly and annual energy use for each primary meter, submeter and power monitor device to comply with 2021 IECC 405.12/406 Energy Metering requirements.
- G. COMMUNICATION COMPONENTS AND NETWORKS:
1. Provide communications and control network, network hardware, software to effect acquisition of energy and power data between the Central Energy & Power/Display Processor and primary meter, submeters and power monitor devices. Include all interconnection connectivity, active equipment, communication interfaces, wires and cables as required.
 2. Provide communications modules, hardware, interface cards, etc. and software to communicate between the Central Energy & Power Display Processor and the building BAS/BMS system.
- H. CABLE SYSTEMS:
1. RS-485 Cable: PVC jacketed, paired, 2 pairs, twisted, No. 22 gauge minimum, stranded.
 2. Unshielded Twisted Pair - Category 6 minimum, as specified in Telecom cabling section.
 3. Other cables: as recommended by Energy & Power Metering system manufacturer.
 4. Certified for use at data speeds up to at least 100 Mbps.
- I. FACTORY REQUIREMENTS:

1. Energy and Power meters, submeters, power monitoring devices and ancillary components shall be factory-installed, wired and tested prior to shipment to the jobsite.
2. All control power, CT, PT and data communications wire shall be factory-wired, harnessed and terminated within the switchboards, panelboards and equipment enclosures.
3. Where external connections are required, terminal blocks shall be provided and the manufacturer's drawings shall clearly identify the interconnection requirements for external wiring, including wire type to be used.

PART 3 - EXECUTION

3.1 INSTALLATION OF ENERGY AND POWER METERING SYSTEM:

- A. Install equipment and components in accordance with manufacturer's written instructions with recognized industry practices to ensure that installation complies with requirements of NEMA and NEC standards, and applicable portions of NECA's "Standard of Installation".
- B. Energy and Power monitoring components shall be factory installed, wired and tested prior to shipment to the jobsite.
- C. Network hardware shall be installed in accordance with the manufacturer's instructions.
- D. Software (as applicable) shall be designed specifically for energy, power monitoring and control. The software shall be a standard product offering with no customization required. The software shall be configured by the manufacturer's qualified technician.
- E. Electrical Identification: As required by the manufacturer, and as specified in Section 260553 Electrical Identification for requirements.

3.2 WIRING:

- A. All wiring external to metering equipment, switchboards and panelboards shall be installed in metallic conduit and provided with necessary junction and pull boxes. The electrical contractor shall provide all wiring and conduit, boxes, and rough-in. Wiring types and characteristics shall comply with equipment manufacturer recommendations. Care shall be exercised in wiring installation to avoid damage to the cables. Cables shall be pulled continuous without splicing, leaving ends in lengths as directed by the manufacturer's qualified technician.
- B. After all wiring, circuits and cables have been pulled and completed from one extremity to the other, the electrical contractor shall check all wiring free of opens, shorts and grounds.
- C. Provide equipment grounding connections, sufficiently tight to assure permanent and effective ground.
- D. The manufacturer's qualified technician shall calibrate, test and adjust the metering system and make all final connections to the metering equipment.

3.3 FIELD QUALITY CONTROL:

- A. Prior to system energization, check all power and control wiring for electrical continuity and communications wiring for signal integrity.
- B. EQUIPMENT CHECK-OUT: Provide equipment check-out by manufacturer's trained and authorized technician.
- C. TESTNG: Upon completion of installation of system, demonstrate system operation, capability and compliance with requirements. Where possible, correct malfunctioning equipment at site, then retest to demonstrate compliance. Otherwise, remove and replace

with new equipment, and proceed with retesting.

- D. Subsequent to wire and cable connections, energize electrical system and demonstrate functioning in accordance with requirements.

3.4 TRAINING:

- A. Provide a minimum of four hours of in-service training with owner personnel.

END OF SECTION 26 1010

SECTION 26 2200 - TRANSFORMERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of transformer work is indicated by drawings and schedules. Work includes complete installation and electrical connections.
- B. Types of transformers in this section include the following:
 - 1. Dry-type Distribution Transformers

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to installation and construction of electrical power/distribution transformers; with applicable portions of NEMA Std. Pub. Nos. TR1 and TR27; and with applicable ANSI/IEEE standards pertaining to power/distribution transformers.
- B. Comply with applicable portions of ANSI/UL 506; "Safety Standard for Specialty Transformers". Provide distribution transformers that have been UL listed and labeled.
- C. All characteristics, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revision of the following ANSI/IEEE, NEMA, and Department of Energy standards.
 - 1. C57.12.00 – IEEE Standard for Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
 - 2. C57.12.28 – Pad-Mounted Equipment - Enclosure Integrity.
 - 3. C57.12.34 – IEEE Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers (2500 kVA and Smaller) - High Voltage: 34500GrdY/19920 Volts and Below; Low-Voltage: 480 Volt 2500 kVA and Smaller (issued in March 2005 - combines C57.12.22 and C57.12.26).
 - 4. C57.12.90 – IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.
 - 5. C57.12.91 – Guide for Loading Mineral-Oil-Immersed Transformers.
 - 6. NEMA TR 1-1993 (R2000) – Transformers, Regulators and Reactors, Table 0-2 Audible Sound Levels for Liquid-Immersed Power Transformers.
 - 7. NEMA 260-1996 (2004) – Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas.
 - 8. 10 CFR Part 431 – Department of Energy – Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule.
 - 9. NEMA ST-20 - Dry-Type Transformers for General Applications

10. NEMA TP-1-2002 – Standards for transformer energy efficiency.

1.4 SUBMITTALS:

A. Refer to Section 260502 for electrical submittal requirements.

PART 2 - PRODUCTS

2.1 DRY -TYPE DISTRIBUTION TRANSFORMERS:

A. GENERAL: Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.

B. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type of transformer):

1. Acme Transformer Company
2. GE/ABB
3. Cutler Hammer Products, Eaton Corp.
4. Federal Pacific
5. Hevi-Duty Electric Div., General Signal Corp.
6. Jefferson Electric
7. Schneider Electric/Square D Co.
8. Hammond Power Solutions
9. Siemens Energy & Automation, Inc.

C. DRY-TYPE DISTRIBUTION TRANSFORMERS (GENERAL PURPOSE):

1. Provide factory-assembled, general-purpose, air-cooled, aluminum wound dry-type distribution transformers where shown; of sizes, characteristics, and rated capacities indicated. Provide primary winding with minimum of 4 full capacity taps; each 2-1/2 percent, two above and two below full-rated voltage for de-energized tap-changing operation.
2. Insulate with 220 degree C. UL recognized insulation system for 150° degree C rise above 40o ambient at full load.
3. Limit sound levels to the following (as determined by ANSI/NEMA standards):
 - a. 30-50 KVA 45 dB
 - b. 51-150 KVA 50 dB
 - c. 151-300 KVA 55 dB
 - d. 301-500 KVA 60 dB
 - e. 501-1000 KVA 64 dB
4. Provide terminal enclosure, with cover, to accommodate primary and secondary coil wiring connections. Equip terminal leads with connectors installed, suitable for copper or aluminum wiring. Cushion-mount transformer with vibration isolation supports. Provide transformers with ventilated, heavy gauge sheet steel enclosures. Apply manufacturer's standard light gray indoor enamel over cleaned and phosphatized steel enclosure. Provide transformers suitable for wall and floor mounting as indicated.

5. The percent impedance voltage, as measured on the rated voltage connection, shall be per Table 2.

Table 2 Percent Impedance Voltage (Dry-Type)	
KVA Rating (Secondary Voltage < 700 V)	Impedance
0 - 75	3.00 – 5.75%
112.5 - 225	4.00 - 5.75%
300 and above	5.00 - 5.75%

D. DRY-TYPE DISTRIBUTION TRANSFORMERS (K-RATED):

1. Provide factory-assembled, air-cooled, copper wound dry-type distribution transformers where shown; of sizes, characteristics, and capacities indicated, and UL listed for non-sinusoidal current loads of K-factor 13 (shown on drawings). See ANSI/IEEE C57.110-1986 for K-factor and UL Std 1561. Provide primary windings with a minimum of 4 full capacity taps; each 2-1/2 percent, two above and two below full-rated voltage for de-energized tap changing operator.
2. Insulate with 220 degree C UL recognized insulation system for 150° degree C rise above 40oC ambient at full load.
3. Include an electrostatic shield for attenuation of spikes, line noise, and transients. Wind coils with foil wrap to minimize effects caused by harmonic currents above the fundamental frequency. Provide transformer with neutral conductor and lugs sized at two times rated phase current.
4. Limit sound levels to the following:
 - a. 30-50 KVA 45 dB
 - b. 51-150 KVA 50 dB
 - c. 151-300 KVA 55 dB
 - d. 301-500 KVA 60 dB
 - e. 501-1000 KVA 64 dB
5. Provide terminal enclosure, with cover, to accommodate primary and secondary coil wiring connections. Equip terminal leads with connectors installed, suitable for copper or aluminum wiring. Cushion-mount transformer with vibration isolation supports. Provide transformers with ventilated, heavy gauge sheet steel enclosures. Apply manufacturer's standard light gray indoor enamel over cleaned and phosphatized steel enclosure. Provide transformers suitable for wall and floor mounting as indicated.
6. The percent impedance voltage, as measured on the rated voltage connection, shall be per Table 3.

Table 3 Percent Impedance Voltage (Dry-Type, K-rated)	
KVA Rating (Secondary Voltage < 700 V)	Impedance
0 - 75	3.00 – 5.75%
112.5 - 225	4.00 - 5.75%
300 and above	5.00 - 5.75%

PART 2 – EXECUTION

2.1 INSTALLATION OF TRANSFORMERS

- A. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.
- B. Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.
- C. Connect transformer units to electrical wiring system; comply with requirements of other Division-26 sections.
- D. **MOUNTING:** Provide concrete pad under all floor mounted equipment and equipment mounted at grade. Anchor transformer to pad with 3/8" expansion anchors at each corner of enclosure. Provide vertical and lateral support systems for all transformers that are supported from overhead structure. See drawings for support and attachment details. Provide neoprene vibration isolators at each anchor point.
- E. **GROUNDING:** Provide tightly fastened equipment grounding and bonding connections for transformers.
- F. **TESTING:** Upon completion of installation of transformers, energize primary circuit at rated voltage and frequency from normal power source and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 26 2200

JORDAN SCHOOL DISTRICT (JSD) HAS PREVIOUSLY PROCURED THE CT/MS, MDP, AND LDP SWITCHGEAR. DIVISION 26 SHALL INCLUDE WITHIN THEIR BID PACKAGE THE RECEIVING AND INSTALLATION OF THE PREVIOUSLY PROCURED CT/MS, MDP AND LDP ALONG WITH THE ENTIRETY OF THE REMAINING GEAR, EQUIPMENT, FEEDERS, AND THE COMPREHENSIVE INSTALLATION OF THE ENTIRE ONE-LINE AND ELECTRICAL INFRASTRUCTURE WITHIN THEIR BID. DIVISION 26 WILL SHOULDER THE RESPONSIBILITY OF BOTH RECEIVING THE ITEMS AND ENSURING THE COMPLETE INSTALLATION OF THE ELECTRICAL SYSTEM, ALONG WITH ALL OTHER NECESSARY PREREQUISITES TO ESTABLISH A FULLY FUNCTIONAL ELECTRICAL SYSTEM. COORDINATE WITH CODALE ELECTRICAL SUPPLY AS REQUIRED.

SECTION 26 2413 - SWITCHGEAR AND SWITCHBOARDS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and methods sections apply to work of this section except as otherwise indicated. See Section 262713 Service Entrance, for metering requirements. See Section 264313 for SPD requirements.

1.2 DESCRIPTION OF WORK:

- A. Extent of switchgear and switchboards is indicated by drawings and schedules.
- B. Types of switchgear and switchboards in this section include the following:
 - 1. AC Dead Front Switchboards (600V)

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to construction and installation of electrical switchgear and switchboards. Provide switchgear and switchboards that have been UL listed and labeled.

1.4 SUBMITTALS:

- A. Refer to Section 26 0502 for electrical submittal requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide products of one of the following (for each type of switchgear and switchboard):
- B. AC DEAD FRONT SWITCHBOARDS (600V):
 - 1. Square D Co. (Basis of Design)
 - 2. Cutler-Hammer Products, Eaton Corp.
 - 3. GE/ABB
 - 4. Siemens Energy & Automation, Inc.

2.2 EQUIPMENT SECTIONS AND COMPONENTS:

- A. GENERAL: Except as otherwise indicated, provide switchgear and switchboards of types, sizes, characteristics, and ratings indicated, that comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation. See drawings and Section 262815. Series rated systems are not accepted.
- B. Overcurrent Protection Devices, for main and branch devices. Provide switchgear, switchboards, and overcurrent devices of one manufacturer.
- C. Provide each service entrance switchboard with surge protective device (SPD) mounted in a separate enclosure adjacent to the switchboard/switchgear. See Section 264313 for SPD unit requirements. Provide in-line fusing for each phase of the device, and wire in accordance with manufacturer's instructions, with conductor length not exceeding 18".

2.3 AC DEAD-FRONT SWITCHBOARDS (600V):

- A. Provide factory assembled, dead front, metal enclosed, floor standing, self supporting, group mounted, secondary power switch boards, of sizes, electrical ratings and characteristics indicated consisting of panel (vertical) units, and containing circuit breaker and fusible switch assemblies of quantities, ratings and types indicated. Provide aluminum main bus and connections to switching devices of sufficient capacity to limit rated continuous current operating temperature rise to UL standard; with main bus and tap connections silver-surfaced or tin-plated and tightly bolted for maximum interrupting capacity. Provide accessibility of line and load terminations from front of switchboard. Prime and paint switchboard with manufacturer's standard finish and color. Equip units with built-in lifting eyes and yokes; provide individual panel (vertical) units, suitable for bolting together at project site, and constructed for the following environment:
 - 1. Installation: Indoors, NEMA Type 1.
- B. Limit height of upper most overcurrent device handle to 6'-2" to accommodate 4" curb.

PART 3 - EXECUTION

3.1 INSTALLATION OF SWITCHGEAR AND SWITCHBOARDS:

- A. Install switchgear and switchboards where shown, in accordance with manufacturer's written instructions with recognized industry practices to ensure that switchgear and switchboards comply with requirements of NEMA and NEC standards, and applicable portions of NECA's "Standard of Installation".
- B. Install all switchgear and switchboards on 4" high concrete curb and bolt equipment to curb with 5/8" anchors at each corner and at intervals not to exceed 4 feet along perimeter. Install concrete wiring trench under switchgear and switchboards; 18" deep, and 4" smaller in length and width than equipment base. Install grounding bushings on conduits penetrating trench.
- C. Arrange conductors within switchgear and switchboards in neat fashion, and secure with suitable ties.
- D. Tighten fuses, if any, in each switchgear and switchboard.
- E. Provide and install spare fuse cabinet in main electrical room.
- F. Electrical Identification: Refer to Section 260553 for requirements.
- G. Provide a surge protective device on each switchboard located on the emergency distribution system. Refer to Section 26 4313 for requirements.

3.2 ADJUST AND CLEAN:

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finish.

3.3 FIELD QUALITY CONTROL:

- A. Prior to energization of switchgear and switchboards, check with ground resistance tester phase to phase and phase to ground insulation resistance levels to ensure requirements are fulfilled.
- B. Prior to energization, check switchgear and switchboards for electrical continuity of circuits, and for short circuits.
- C. Subsequent to wire and cable connections, energize switchgear and switchboard and demonstrate functioning in accordance with requirements.

END OF SECTION 26 2413

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SECTION 26 2416 - PANELBOARDS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to panelboards specified herein.

1.2 DESCRIPTION OF WORK:

- A. The extent of panelboard and enclosure work, is indicated by drawings and schedules.
- B. Types of panelboards and enclosures in this section include lighting and appliance panelboards, and power distribution panelboards.

1.3 QUALITY ASSURANCE:

- A. Provide units that have been UL listed and labeled. Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with NEC pertaining to installation of wiring and equipment in hazardous locations. Comply with NEMA Stds. Pub No. 250, "Enclosures for Electrical Equipment (1000 volt maximum). Pub No. 1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".

1.4 SUBMITTALS:

- A. Refer to Section 260502 for electrical submittal requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide of one of the following:
 - 1. Square D Company (Basis of Design)
 - 2. Cutler Hammer Products, Eaton Corp.
 - 3. GE/ABB
 - 4. Siemens Energy & Automation, Inc.

2.2 PANELBOARDS:

A. GENERAL:

- 1. Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated. Equip with number of unit panelboard devices as required for complete installation. Fully equip "spaces" with hardware to receive breaker or switch of size indicated. Provide CU/AL rated lugs of proper size to accommodate conductors specified.

B. POWER DISTRIBUTION PANELBOARDS:

- 1. Provide dead-front safety type power distribution panelboards as indicated, with switching and protective devices in quantities, ratings, types and with arrangement shown. Equip with aluminum bus bars, full-sized neutral bus and

ground bus. Provide fusible or circuit breaker branch and main devices as indicated. Series rated systems are not acceptable. See Section 262815, Overcurrent Protection Devices.

C. LIGHTING AND APPLIANCE PANELBOARDS:

1. Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types, and arrangement shown. Provide bolt-on thermal magnetic type branch breakers. Where multiple breakers are indicated, provide with common trip handle. Series rated systems are not acceptable. Equip with aluminum bus bars, full-sized neutral bus, and ground bus.

D. PANELBOARD ENCLOSURES:

1. Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage minimum 16-gage thickness. Provide door-in-door hinged fronts. Provide fronts with adjustable indicating trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor. Provide enclosures fabricated by same manufacturer as overcurrent devices contained therein Bolt engraved plastic laminate labels indicating panel name and voltage on the interior and exterior of panelboards.
2. Provide floor to ceiling panel extensions for all surface mounted panels located outside of mechanical and electrical rooms.

E. FINISH:

1. Coat interior and exterior of surface with manufacturer's standard color; baked on enamel finish.

F. ELECTRICAL IDENTIFICATION:

1. Refer to Section 260553 for requirements.

PART 3 – EXECUTION

3.1 INSTALLATION OF PANELBOARDS:

A. GENERAL:

1. Install panelboards and enclosures where indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", in compliance with recognized industry practices to ensure products fulfill requirements.
2. Provide a surge protective device on each panelboard located on the emergency distribution system. Refer to section 26 4313 for requirements.

B. MOUNTING:

1. Provide 4" high concrete curb under floor standing distribution panelboards.
2. Coordinate installation of panelboards and enclosures with cable and raceway installation work. Anchor enclosures firmly to walls and structural surfaces, ensuring they are permanently and mechanically secure. Arrange conductors neatly within enclosure, and secure with suitable nylon ties. Fill out panelboard's circuit directory card upon completion of installation work. Utilize actual final building room numbers, not architectural numbers used on drawings. Identify individual lighting circuits and individual receptacle circuits by room served. Label circuit breakers to identify location of subpanel or equipment supplied using room numbers and equipment names. Include room number with equipment circuit designations. All directories to be typewritten.

END OF SECTION 26 2416

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SECTION 26 2713 - SERVICE ENTRANCE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of service-entrance work is indicated by drawings and schedules.
- B. Switchboards, panels, disconnects, transformers, etc., used for service-entrance equipment are specified in applicable Division-26 sections, and are included as work of this section.
- C. Consult local utility relative to all costs for line extensions, connections, etc., and include all costs for bringing service to the facility in base bid. Confirm location of point of service before bidding.
- D. Provide labor and materials as required to accomplish power company metering in accordance with power company standards and requirements.
- E. Coordinate installation of concrete pads of size and type required for service transformers. Verify location, size, openings, reinforcing requirements with Rocky Mountain Power before beginning work. Comply with Rocky Mountain Power code required clearance requirements.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC and NEMA standards as applicable to construction and installation of service-entrance equipment and accessories. Provide service-entrance equipment and accessories that are UL-listed and labeled, and equipment marked, "Suitable for use as Service Equipment".

1.4 SUBMITTALS: REFER TO Section 26 0503 for requirements.

- A. MAINTENANCE STOCK, FUSES: Refer to Section 26 0503 for requirements.

PART 2 – PRODUCTS

2.1 SERVICE - ENTRANCE EQUIPMENT:

- A. GENERAL: Provide service-entrance equipment and accessories, of types, sizes, ratings and electrical characteristics indicated, that comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation, and as herein specified.
- B. Provide each service entrance switchboard with Surge Protective Devices as required by Section 264313.

2.2 OVERCURRENT PROTECTIVE DEVICES:

- A. GENERAL: Provide overcurrent protective devices complying with Division-26 section "Overcurrent Protective Devices", and as indicated on drawings.

2.3 METERING:

- A. METER SOCKETS: Provide meter sockets that comply with requirements of local utility company supplying electrical power to service-entrance equipment of building project.
- B. METERS: Provide meters, current and potential transformers, selector switches, wiring, etc. for a complete metering system. Provide meter of same manufacturer as switchboard (equal to Square D Power Logic Circuit Monitor, Class 3020, Model CM-3250), integrally mounted in service equipment, completely wired with control power input. Provide capability for metering the following data:

<u>INSTANTANEOUS READINGS</u>	<u>DEMAND READINGS</u>
<u>RMS Current Values</u>	<u>Current Values</u>
Phase A Current	Average Demand Current Phase A
Phase B Current	Average Demand Current Phase B
Phase C Current	Average Demand current Phase C
3-Phase Average Current	Peak Demand Current Phase A
Apparent RMS Current	Peak Demand Current Phase B
RMS Voltage Values	Peak Demand Current Phase C
Phase A-B Voltage	Real Power Values
Phase B-C Voltage	Average Demand Real Power
Phase C-A Voltage	Predicted Demand Real Power
Phase A-N Voltage	Peak Demand Real Power
Phase B-N Voltage	Phase C-N Voltage
<u>Power Factor Values</u>	<u>Energy Readings</u>
Phase A Power Factor	-
Phase B Power Factor	Energy Accumulated
Phase C Power Factor	Reactive Energy Accumulated
3-Phase Total Power Factor	-
3-Phase Total Power Values	-
Real Power, 3-Phase Total	-
Reactive Power, 3-Phase Total	-
Apparent Power, 3-Phase Total	-
Frequency	-
Temperature	-

- C. Provide with integral display, selection keys, and indicating LEDs. For each instantaneous reading, provide a running maximum and minimum history in non-volatile memory, capable of externally operated reset. Provide "waveform capture" feature to allow subsequent analysis of actual current and voltage profile for harmonic distortion.
- D. Provide in interfaceable meter with BACnet compatibility in the main switchgear.

2.4 RACEWAYS AND CONDUCTORS:

- A. GENERAL: Provide raceways and conductors complying with applicable Division-26 Basic Materials and Methods sections.
- B. WALL AND FLOOR SEALS: Provide wall and floor seals complying with Division-26

Basic Materials and Methods section "Raceways".

- C. Fluidized thermal backfill (FTB): Provide fluidized thermal backfill (FTB) around service lateral conduits (Service Lateral: Conductors/conduits between RMP transformer and meter. See NEC Article 230) when there are seven or more conduits specified. FTB shall comply with requirements of Pacificorp material specification ZG071.

PART 3 – EXECUTION

3.1 INSTALLATION OF SERVICE-ENTRANCE EQUIPMENT:

- A. Install service-entrance equipment as indicated, in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that service-entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA standards.
- B. Coordinate with other work, including utility company wiring, as necessary to interface installation of service-entrance equipment work with other work.
- C. Install all floor standing service equipment on 4" high concrete curb and bolt equipment to curb with 3/8" anchors at each corner and at intervals not to exceed 8' along perimeter. Install concrete wiring trench under floor standing equipment; 12" deep, and 4" smaller in length and width than equipment base. Install grounding bushings on conduits penetrating trench.

3.2 GROUNDING:

- A. Provide system and equipment grounding and bonding connections for service-entrance equipment and conductors, as required.

3.3 ADJUST AND CLEAN:

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred enclosure surfaces to match original finishes.

3.4 FIELD QUALITY CONTROL:

- A. Upon completion of installation of service-entrance equipment and electrical circuitry, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 26 2713

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SECTION 26 2726 - WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems that are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
 - 1. Receptacles
 - 2. Switches
 - 3. Timer Switches
 - 4. 0-10V & ELV LED LAMP DIMMERS
 - 5. Cord caps
 - 6. Cord connectors
 - 7. Flat Panel Display Wall Box
 - 8. Poke-through assemblies
 - 9. Telephone/power poles
 - 10. Dryer Interlock Control Box

1.3 QUALITY ASSURANCE:

- A. Comply with NEC and NEMA standards as applicable to construction and installation of electrical wiring devices. Provide electrical wiring devices that have been UL listed and labeled.

1.4 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 - PRODUCTS

2.1 FABRICATED WIRING DEVICES:

- A. GENERAL:
 - 1. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA Stds. Pub No. WD 1.
- B. Provide PlugTail only wiring devices (of proper voltage rating) as follows:

	<u>RECEPTACLE</u>	<u>SWITCHES</u>			
<u>MFGR</u>		<u>1-POLE</u>	<u>3-WAY</u>	<u>4-WAY</u>	<u>W-PILOT</u>
Hubbell	BR20XTR	HBL 1221	HBL 1223	HBL 1224	HBL 1221-PL
Pass Seymour	TR63X	20AC1	20AC3	20AC4	20AC1-RPL
Leviton	TWR20-X	1221	1223	1224	
Cooper	TR5362	1221	1273	1224	1221-PL

- C. Provide devices in colors selected by Architect. Provide red devices on all emergency circuits.
- D. SURGE PROTECTIVE (SPD) RECEPTACLES:
- Provide SPD receptacles having 4 series parallel 130V MOV's capable of a minimum of 140 joules suppression. Provide units with visual (and audible) surge status indicators to monitor condition of surge circuit; visual indicator to be "on" when power present and suppression circuit is fully functional. (Audible indicator shall sound a "beep" alarm approximately every 30 seconds if suppression circuit has been damaged.) Provide NEMA 5-20R, 20 amp, 125V receptacle of one of the following manufacturers:

	<u>MANUFACTURER</u>	
<u>SPECIFICATION GRADE</u>	<u>HUBBELL</u>	<u>PASS SEYMOUR</u>
Duplex Recept-Visual only	5350	5352 XXXSP
Duplex Recept-Visual/Audible	5352	5362 XXXSP
Single Recept-Visual only	5351	N/A
Duplex Recept-Isol Gnd, Visual/Audible	IG5352S	IG5362 XXXSP
Single Recept-Isol Gnd, Visual only	IG5351S	N/A
<u>HOSPITAL GRADE</u>	<u>HUBBELL</u>	<u>PASS SEYMOUR</u>
Duplex Recept-Visual/Audible	8300HS	8300 XXXSP
Single Recept-Visual only	8310HS	N/A
Duplex Recept-Isol Gnd, Visual/Audible	IG8300HS	IG8300 XXXSP
Single Recept-Isol Gnd, Visual only	IG8310HS	N/A

- Provide (1) SPD receptacle in all Flat Panel Display Wall Boxes ('DP' symbol)
 - Color of devices selected by Architect. Provide red devices on all emergency circuits.
- B. GROUND-FAULT INTERRUPTER:
- Provide general-duty, duplex receptacle, ground-fault circuit interrupters; feed-thru types, capable of protecting connected downstream receptacles on single circuit; grounding type UL-rated Class A, Group A, 20-amperes rating; 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 milliamperes ground-fault trip level; color as selected by Architect. Provide Hospital grade

where required elsewhere by specification or drawings. Provide units of one of the following:

- a. P&S/Sierra
- b. Hubbell
- c. Leviton
- d. Square D

C. USB RECEPTACLE

1. Provide duplex receptacle with two (2) USB 3.0 amps, 5VDC, (1) Type A and (1) type B charging ports.
2. Provide products of one of the following:
 - a. Bryant – USB20-X
 - b. Cooper – TR7736-X
 - c. Hubbell – USB20X2-X
 - d. Legrand – TR5362USB-X
 - e. Leviton – T5832-X

D. TAMPER RESISTANT RECEPTACLES:

1. Provide tamper resistant receptacles in pre-school and elementary education facilities.

E. WEATHER-RESISTANT RECEPTACLES

1. Provide weather-resistant receptacles in outdoor locations such as under roofed open porches, canopies, marquees, etc.
2. Provide products of one of the following:
 - a. Pass & Seymour 2095TRWRXXX.
 - b. Hubbell GFTR20XX

F. CORD CAPS AND CONNECTORS:

1. Provide 3, 4 and 5-wire grounding, cap plugs, and connectors of ampere and voltage rating required, for final equipment, and as indicated otherwise on drawings.
2. Provide products of one of the following:
 - a. Cooper
 - b. General Electric
 - c. Hubbell
 - d. Leviton
 - e. P&S

G. TIMER SWITCH:

1. Provide a timer switch with the following features and functionalities. Provide switch that mounts in a standard wall box. Provide a Decora style cover plate that matches the other switches on the project. Provide color of switch chosen by Architect.
 - a. Provide Digital time switches that automatically turn lights off after a preset time. User programmable wall switch for astronomical and scheduled control. Electroluminescent back-lit LCD shows timer countdown. Compatible with all electronic ballasts, ELV, MLV, LED, and motor loads.
 - i. Wattstopper TS-400: 120/277VAC; 50/60 Hz
 - ii. Greengate
 - b. Provide Astronomical time switches that automatically turns lighting or other loads on and off according to user programming. Time-out settings range shall range from 5 minutes to 12 hours for flexibility. Electroluminescent back-lit LCD shows timer countdown. Compatible with all electronic ballasts, ELV, MLV, LED, and motor loads. Program schedule per the owner's requirements.
 - i. Wattstopper RT-200: 120/277VAC; 50/60 Hz
- H. 0-10V & ELV LED LAMP DIMMERS:
1. Provide single-pole, semi-conductor modular type 0-10V control for 0-10V fluorescent ballasts/LED drivers & 3-wire fluorescent ballast/LED driver dimmers for fixtures; 60 hertz, with wattage and voltage as indicated, continuously adjustable slider control, and with electromagnetic filters to reduce noise and interference to minimum. Construct with continuously adjustable trim potentiometer for adjustment of low end dimming. Dimmer shall match lamp/ballast combination. Color as selected by Architect. Provide devices manufactured by one of the following:
 - a. Pass & Seymour (Titan Series)
 - b. Wattstopper – PW-311 Series
 - c. Lutron (Nova Series)
 - d. Lutron (Diva Series)
- 2.2 WIRING DEVICE ACCESSORIES:
- I. WALL PLATES:
 1. Provide stainless steel coverplates in all finished areas. Provide galvanized steel plates in unfinished areas. Provide blank coverplates for all empty outlet boxes.
 - J. WEATHER-PROTECTING DEVICE ENCLOSURES:
 1. Where required for compliance with NEC 406-8 (receptacles installed outdoors for use other than with portable tools or equipment), provide weather-tight device covers that provide complete protection with the cord and cap inserted into the wiring device. Provide units that mount on either single or double gang devices.
 2. Provide products of one of the following extra-duty low-profile expandable in-use weatherproof covers for exterior mounted installations:

- a. Intermatic
 - i. WP7000W Single-Gang/White Cover
 - ii. WP7000G Single-Gang/Gray Cover
 - iii. WP7000BR Single-Gang/Brown Cover
 - iv. WP7200W Double-Gang/White Cover
 - v. WP7200G Double-Gang/Gray Cover
 - vi. WP7200BR Double-Gang/Brown Cover
- b. Tayac
 - i. ML500W Single-Gang/White Cover
 - ii. ML500G Single-Gang/Gray Cover
 - iii. ML500Z Double-Gang/Brown Cover
 - iv. ML2500G Single-Gang/Gray Cover
- c. Color chosen by architect.

3. Provide products of one of the following for roof mounted installations:

- a. Intermatic WP1020 or WP1030
- b. P&S WIUC10C or WIUC20C

2.3 FLAT PANEL DISPLAY WALL BOX:

K. Provide a factory assembled display wall box made of 14 gauge steel. Wall box shall have provisions for a UL Listed single gang box for mounting of duplex receptacle and additional back box with a minimum of (1) 1 ¼" conduit opening to allow for low voltage terminations. Coordinate low voltage plate configuration with drawings. Provide device manufactured by one of the following:

- 1. Chief – PAC526FCW
- 2. Wiremold – EFSB4

2.4 POKE-THROUGH ASSEMBLY DEVICES:

L. Provide factory-assembled poke-through assembly devices equipped with wiring devices as specified herein; capable of maintaining fire floor rating of 3 hours. Unit shall be UL514A listed. Construct for installation in concrete floor with center tube, fire-stop wafers, spreader plates, service fitting base plate, and 4-11/16" conduit box. Provide service fitting with alignment adjustment screws for complete installation; finish as selected by Architect. Provide devices manufactured by one of the following:

- 1. Hubbell
- 2. Wiremold Co.

M. Provide the following poke-thru assemblies as noted on the drawings.

2.5 DRYER INTERLOCK CONTROL BOX:

N. Provide a factory complete & assembled dryer starter control box for dryer locations

where interlocking the booster/exhaust fans are required. Control box shall have provisions for a UL Listed pre-wired unit with dryer plug for easy and simple installation. This control works shall work in conjunction with the booster fan. When booster fan is in "ON" it will engage power to the starter control box and only then the dryer can be turned "ON". Coordinate with mechanical contractor and refer to mechanical drawings for booster/exhaust fan locations and exact termination requirements. Provide device manufactured by one of the following

1. S&P - IL230 or equal

2.6 TELEPHONE/POWER POLES:

O. Provide factory-assembled telephone/power poles of types, sizes and ratings indicated; for use with telephone and power systems installed above suspended ceilings. Provide with 2 duplex receptacles as specified herein. Isolate power section from telephone compartment with separating steel enclosure. Extend wiring from receptacles to junction box at top of pole where connections are made above suspended ceiling. Provide pole foot with carpet pad and ceiling tile trim pad. Provide poles in color selected by Architect, manufactured by one of the following:

1. Hubbell
2. Wiremold Co.

PART 3 – EXECUTION

3.1 GENERAL

- A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work. Install devices in boxes such that front of device is flush and square with coverplate. Drawings are small scale and, unless dimensioned, indicate approximate locations only of outlets, devices, equipment, etc. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned and coordinate with other work. Verify all dimensioned items on job site. Consult architectural cabinet, millwork, and equipment shop drawings before beginning rough-in of electrical work. Adjust locations of all electrical outlets as required to accommodate work in area, and to avoid conflicts with wainscoat, back splash, tackboards, and other items.
- C. Provide receptacles in surface raceway at 12" on center unless indicated otherwise.
- D. Install wiring devices only in electrical boxes that are clean; free from excess building materials, dirt, and debris.
- E. Install blank plates on all boxes without devices.
- F. Delay installation of wiring devices until wiring work and painting is completed. Provide separate neutral conductor from panel to each GFI receptacle.
- G. Install GFI receptacles for all receptacles installed in the following locations:
 1. Restrooms, locker rooms, kitchens, within 6 feet of any sink, or when serving vending machines and electric drinking fountains.
 2. Indoor wet locations, non-dwelling garages, elevator rooms and pits.
 3. Outdoors, and on rooftops.

- 4. Dwelling unit garages, crawlspaces and unfinished basements, accessory buildings, boathouses, and receptacles for boat hoists.
 - H. Where light switches or wall box dimmers are specified, provide a separate neutral for each phase of the branch circuits that switches or dimmers are connected.
 - I. Electrical Identification: Refer to Section 260553 for requirements.
- 3.2 PROTECTION OF WALL PLATES AND RECEPTACLES:
- A. At time of substantial completion, replace those items, that have been damaged, including those stained, burned and scored.
- 3.3 GROUNDING:
- A. Provide electrically continuous, tight grounding connections for wiring devices, unless otherwise indicated.
- 3.4 TESTING:
- A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 26 2726

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SECTION 26 2815 - OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to overcurrent protective devices specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of overcurrent protective device work is indicated by drawings and schedules and specified herein. Overcurrent protective devices specified herein are for installation as individual components in separate enclosures; and for installation as integral components of switchboard and panelboards. See Section 262413, Switchgear and Switchboards, and Section 262416, Panelboards.
- B. Types of overcurrent protective devices in this section include the following for operation at 600 Volts and below:
 - 1. Molded case thermal circuit breakers
 - 2. Molded case solid-state circuit breakers
 - 3. Insulated case circuit breakers
 - 4. Power circuit breakers
 - 5. Fuses
- C. Refer to other Division-26 sections for cable/wire and connector work required in conjunction with overcurrent protective devices.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC requirements and NEMA and ANSI standards as applicable to construction and installation of overcurrent devices.

1.4 SUBMITTALS:

- A. Refer to Section 260502 for electrical submittal requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide products of one of the following (main and branch device manufacturer must be same as panelboard and/or switchboard manufacturer):
- B. CIRCUIT BREAKERS AND FUSIBLE SWITCHES:
 - 1. Cutler Hammer Products, Eaton Corp.
 - 2. General Electric Co.
 - 3. Square D Co.
 - 4. Siemens Energy and Automation

C. MOLDED CASE THERMAL TRIP CIRCUIT BREAKERS:

1. Provide factory-assembled, molded case circuit breaker for power distribution panelboards and switchboards; and for individual mounting, as indicated. Provide breakers of amperage, voltage, and RMS interrupting rating shown, with permanent thermal trip and adjustable instantaneous magnetic trip in each pole. Series rated systems are not acceptable. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40 degrees C. Provide with mechanical screw type removable connector lugs, AL/CU rated, of proper size to accommodate conductors specified.
2. Circuit breakers 15 amps through 399 amps shall be molded case thermal trip circuit breakers.

D. MOLDED CASE SOLID-STATE CIRCUIT BREAKERS:

1. Provide factory-assembled, molded case solid-state circuit breakers for power distribution switchgear and switchboards. Provide breakers of amperage, voltage and RMS interrupting rating shown, and with solid-state trip mechanisms. Breakers shall be UL listed for application at 100% of their continuous ampere rating.
2. Circuit breakers 400 amps through 1199 amps shall be molded case solid-state circuit breakers.
3. Solid-state trip mechanisms shall have the following functions: Adjustable long time ampere rating; adjustable long time delay; adjustable short time pick up; adjustable short time delay and adjustable instantaneous pick up.

E. INSULATED CASE CIRCUIT BREAKERS

1. Provide factory-assembled, insulated case circuit breakers for power distribution switchgear and switchboards. Provide breakers of amperage, voltage and RMS interrupting rating shown, with solid-state trip mechanisms and with manual spring charging mechanism. Breakers shall be UL listed for application at 100% of their continuous ampere rating.
2. Circuit breakers 1200 amps and larger shall be insulated case circuit breakers.
3. Solid-state trip mechanisms shall have the following functions: Adjustable long time ampere rating; adjustable long time delay; adjustable short time pick up; adjustable short time delay and adjustable instantaneous pick up.
4. On service disconnect breakers where phase to ground voltage exceeds 150V and the breaker is capable of being set at or over 1000A (and also where GFP protection is indicated on the one line diagram for downstream breakers), the solid-state trip mechanism shall also include the following:
 - a. Adjustable ground fault pick up and adjustable ground fault time delay, and ground fault test button.
 - b. Over/under voltage trip
 - c. Current imbalance trip
5. Provide an energy-reducing maintenance switch with local, lit status indicator to allow for a reduction of the instantaneous pickup and instantaneous delay settings for use during maintenance. Device shall mount in face of dead-front. The switch shall be provided by the same manufacturer as the circuit breaker.
6. Include integral phase failure (single-phasing) protection where phase failure (PF) is indicated on the one line diagram

F. PHASE FAILURE PROTECTION:

1. Provide phase failure protection on overcurrent protective devices as indicated, by means of a single-phase, dead phase, reverse phase relay (Taylor Electronics Md1 PNDR). Provide relay to operate shunt trip or capacitor trip as required to open overcurrent protective device upon malfunction. Provide relay with adjustable time delay.

G. GROUND FAULT PROTECTION:

1. Provide ground fault sensing and relaying equipment on all overcurrent protective devices where phase to ground voltage is in excess of 150 volts and the overcurrent protection device is capable of being set at or over 1000 amps. Provide ground fault sensing and relaying equipment on other devices as indicated.
2. Provide zero sequence current sensors for overcurrent protective devices; inputs compatible with relay. Construct sensor frame so it can be opened to prevent removal or installation around conductors without disturbing conductors. Provide test winding in sensor for testing operation of GFP unit including sensor pick-up relay, and circuit protection device operation.
3. Provide solid-state ground-fault relay, that requires no external source of electrical power, drawing energy to operate GFP system directly from output of current sensor. Construct with adjustable pick-up current sensitivity for GF current from 200 to 1200 amperes, with calibrated dial to show pick-up point settings. Provide factory-set time delay of 1.5 seconds and protection that precludes tampering with setting after installation.
4. Provide monitor panel capable of indicating relay operation, and provide means for testing system with or without interruption of service. Construct so GF system can not be left in an inactive or OFF state. Provide indicator lamps and TEST and RESET control switches.
5. MANUFACTURER: Subject to compliance with requirements, provide ground-fault sensing and relaying equipment of one of the following:
 - a. General Electric Co.
 - b. Brown Boveri Electric, Inc.
 - c. HI-Z Corporation
 - d. Pringle Electric Mfg. Co.
 - e. Square D Co.

2.2 FUSES:

- A. GENERAL: Except as otherwise indicated, provided fuses of type, sizes and ratings and electrical characteristics of a single manufacturer as follows. Provide fuses labeled UL Class L or UL Class R, current limiting and rated for up to 200,000 amperes. Provide Buss KAZ signal activating fuses where required elsewhere in specification.
- B. Where fuses are shown feeding individual or groups of equipment items, comply with manufacturer's recommendation for fusing; adjust fuse size and type as necessary to comply with manufacturer's recommendation.
- C. Provide and install spare fuse cabinet in main electrical room.
- D. MAIN SERVICE AND FEEDER CIRCUITS: For fuse ratings over 600 amperes provide UL Class L Fuses (KRP-C, or A4BQ or LCL or KLPC). For fuse ratings up to 600 amperes, provide UL Class RK1 (KTN-R, KTS-R or A2K-R, A6K-R or NCCR, SCLR or KLN-R, KLS-R). If fuse directly feeds motors, transformers or other inductive load provide UL RK5 time delay (FRN-R, FRS-R or TR-R, TRS-R or ECN-R, ECS-R or FLN-R, FLS-R).
- E. BRANCH CIRCUITS: For motor circuits, transformer circuits, or other inductive loads,

provide UL Class RK5 (FRN-R, FRS-R or TR-R, TRS-R or ECN-R, ECN-S or FLN-R, FLS-A). For other circuits, provide UL Class RK1, (KTN-R, KTS-R OR A2K-R, A6K-R or NCLR, SCLR OR KLNR, KLSR).

- F. MANUFACTURER: Subject to compliance with requirements, provide fuses of one of the following:
1. Bussman Mfg. Co.
 2. Mersen (Ferraz Shawmut)
 3. Reliance Fuse Div./Brush Fuse Inc.
 4. Littlefuse, Inc.

PART 3 – EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES:

- A. Install overcurrent protective devices as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.
- B. Coordinate with work as necessary to interface installations of overcurrent protective devices with other work.
- C. Install fuses in overcurrent protective devices. For motor circuits, fuse sizes shown on drawings are for general guidance only. Size fuses in accordance with fuse manufacturer's recommendation for given motor nameplate ampere rating. Test operation. If nuisance tripping occurs, increase fuse size and disconnect device (if necessary) as required to provide nuisance free tripping. Adjust fuse size properly for ambient temperature, frequent starting and stopping of motor loads, and for loads with long start times. Include all costs in bid.
- D. After the switchgear is energized and just prior to Substantial Completion, the contractor shall ensure that the field-adjustable circuit breakers and solid-state circuit breakers and associated trip mechanisms have been set to the appropriate settings as recommended by the equipment Manufacturer (or as recommended by the electrical contractor's Protective Device Study if section 260573 has been included in the project). Time-current trip curves and trip setting information as was required in the Submittal portion of this specification shall be made available by the contractor at this time. Provide adjustments to circuit breakers and switchboard AIC ratings as deemed necessary by the analysis/report, with no additional cost to the Owner. Provide over current protection devices with larger frame sizes to ensure coordination has been achieved.
- E. Field test all ground fault protective devices for proper operation; test to be performed by representative of the manufacturer. Include verification of complete time current trip characteristics.
- F. Electrical Identification: Refer to Section 260553 for requirements.

3.2 FIELD QUALITY CONTROL

- A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 26 2815

SECTION 26 2816 - MOTOR AND CIRCUIT DISCONNECTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to motor and circuit disconnect switches specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of motor and circuit disconnect switch work is indicated by drawings and schedule. Work includes complete installations and electrical connections.

1.3 QUALITY ASSURANCE:

- A. Provide motor and circuit disconnect switches that have been UL listed and labeled. Comply with applicable requirements of NEMA Standards Pub. No. KS 1, and NEC.

1.4 SUBMITTALS: REFER TO Section 26 0503 for requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type of switch):
 - 1. Cutler Hammer Products, Eaton Corp.
 - 2. Square D Company
 - 3. General Electric Company
 - 4. Siemens Energy & Automation, Inc.

2.2 FABRICATED SWITCHES:

- A. GENERAL: Provide disconnect and safety switches as indicated herein. Provide:
 - 1. General duty switches on 240 Volt rated circuits.
 - 2. Heavy duty switches on 480 volt rated circuits.
 - 3. HP rated switches on all motor circuits.
- B. GENERAL DUTY SWITCHES: Provide general-duty type, sheet-steel enclosed switches, fusible or non-fusible as indicated of types, sizes and electrical characteristics indicated; rated 240 volts, 60 hertz; incorporating spring assisted, quick-make, quick-break mechanisms. Provide single phase or three phase and with solid neutral as required by application. Equip with operating handle that is capable of being padlocked in OFF position. Provide NEMA 1 or NEMA 3R as required by application, unless noted. Provide fusible switches with Class R rejection fuse clip kits.
- C. HEAVY-DUTY SWITCHES: Provide heavy-duty type, sheet-steel enclosed safety switches, fusible or non-fusible as indicated, of types, sizes and electrical characteristics indicated; rated 600 volts, 60 hertz; incorporating quick-make, quick-break type

mechanisms. Provide single phase or 3 phase, and with solid neutral as required by application, Equip with operating handle that is capable of being padlocked in OFF position. Provide NEMA 1 or NEMA 3R as required by application unless noted. Provide fusible switches with Class R rejection fuse clip kits.

- D. FUSES: Refer to section 26 0503 for requirements.
- E. Electrical Identification: Refer to Section 260553 for requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES:

- A. Install motor and circuit disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products fulfill requirements.
- B. Coordinate motor and circuit disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.
- C. Install disconnect switches used with motor driven appliances, and motors and controllers within sight of controller position.
- D. For disconnect switches serving motors controlled by variable frequency drives, provide late-make, early-break auxiliary contacts on each disconnect switch. (Provide Heavy-Duty switch). Wire auxiliary contact to VFD safety contact, such that disconnecting the motor will shut down the drive first, and closing the switch will start the drive only after power is applied to the motor.
- E. For disconnect switches serving elevators with auxiliary power hydraulic units, provide auxiliary contacts on each disconnect switch. Wire auxiliary contact to auxiliary power such that disconnecting the motor will disconnect the auxiliary power.

END OF SECTION 26 2816

SECTION 26 2913 - MOTOR STARTERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of Division-26 sections making reference to motor starters specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of motor starter work is indicated by drawings and schedules.
- B. Types of motor starters in this section include the following:
 - 1. AC Fraction Horsepower Manual Starters
 - 2. AC Line Voltage Manual Starters
 - 3. AC Non-Reversing Magnetic Starters
 - 4. AC Combination Non-Reversing Magnetic Starters

1.3 QUALITY ASSURANCE:

- A. Comply with NEC and NEMA Standards as applicable to wiring methods, construction and installation of motor starters. Comply with applicable requirements of UL 508, "Electric Industrial Control Equipment", pertaining to electrical motor starters. Provide units that have been UL-listed and labeled.

1.4 SUBMITTALS: Refer to Section for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

- A. Subject to compliance with requirements, provide products of one of the following (for each type and rating of motor starter):
 - 1. Allen-Bradley Co.
 - 2. Appleton Electric Co.
 - 3. Crouse-Hinds Co.
 - 4. Eaton Corp., Cutler Hammer Products
 - 5. General Electric Co.
 - 6. Siemens Energy & Automation, Inc.
 - 7. Square D Co.
- B. MAINTENANCE STOCK, FUSES: Refer to Section for requirements.

2.2 MOTOR STARTERS:

- A. GENERAL: Except as otherwise indicated, provide motor starters and ancillary components; of types, sizes, ratings and electrical characteristics indicated that comply with manufacturer's standard materials, design and construction in accordance with

published information and as required for complete installations.

- B. THERMAL OVERLOAD UNITS: Provide thermal overload units, sized to actual running full load current, not to motor plate current. Size heaters for mechanical equipment after air and water balancing have been completed.
- C. AC FRACTIONAL HP MANUAL STARTERS (EQUAL TO SQUARE D CLASS 2510): Provide manual, single-phase, 1 and 2 pole, 300 volt AC max, fractional HP motor starters, of types, ratings and electrical characteristics indicated; equip with one piece thermal overload relay with field adjustment capability of plus or minus 10 percent of nominal overload heater rating; for protection of AC motors of 1 HP and less. (For manually controlled motors in excess of 1 HP, see Line Voltage Manual Starters specified herein). Provide starter with quick-make, quick-break trip free toggle mechanisms, green pilot lights, and with lock-off toggle operated handle. Mount surface units in NEMA 1 enclosures, unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location unless noted otherwise. Provide flush mounted units with coverplate to match wiring device coverplates.
- D. AC LINE VOLTAGE MANUAL STARTERS (EQUAL TO SQUARE D CLASS 2510): Provide line voltage manual starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volt AC max; equip with pushbutton operator, low voltage protection feature, and green pilot light. Provide starters with trip free mechanism such that contacts will open under load and remain open until thermal element has cooled, and unit is reset. Mount surface units in NEMA 1 enclosure, unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location, unless noted otherwise. Provide overlapping trim for flush mounted units.
- E. AC NON-REVERSING MAGNETIC STARTERS (EQUAL TO SQUARE D CLASS 8536): Provide line voltage magnetic starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volt max, with thermal overload protection in all phases and inherent under voltage release. Equip units with holding contact, 2 normally open, and 2 normally closed auxiliary contacts, unless noted otherwise. Provide fused control transformer in each starter and 120V control coil. Mount hand-off-auto switch, red pilot light, and reset button in face of enclosure. Provide NEMA 1 enclosure unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location, unless noted otherwise. Equip all spare starters complete with items as specified herein.
- F. AC COMBINATION NON-REVERSING MAGNETIC STARTERS (EQUAL TO SQUARE D CLASS 8539): Provide line voltage combination starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volts max with non-reversing magnetic starters as specified herein; in common cubicle or enclosure with motor circuit protector. Provide motor circuit protector, instantaneous trip circuit breaker as indicated and adjust to comply with manufacturer's recommendations. Mount hand-off-auto switch, red pilot light, and reset button in face of enclosure. Provide combination starters for individual mounting, or for group mounting in motor control center as indicated. Provide NEMA 3R enclosure in exterior or damp locations, unless noted otherwise. Provide NEMA 1 enclosures unless otherwise indicated.
- G. AC COMBINATION NON-REVERSING MAGNETIC STARTERS (EQUAL TO SQUARE D CLASS 8538): Provide line voltage combination starters, of types, ratings, and electrical characteristics; 2 or 3 pole, 600 volt maximum with non-reversing magnetic starters as specified herein; in common cubicle or enclosure with fusible disconnect switch. Provide quick-make, quick-break, disconnect for NEMA sizes 1, 2, 3, and 4; and visible blade, automatic circuit interrupters with push-to-trip feature and separate fuse clips for larger NEMA sizes. Fuse all starters with dual-element (time-delay) fuses equal to Bussman FRN/FRS-R. Equip disconnect switch with Class R rejection fuse kits. Mount hand-off-auto switch, red pilot light, and reset button in face of enclosure. Provide combination starters for individual mounting, or for group mounting in motor control

centers as indicated. Provide NEMA 1 enclosures unless otherwise indicated. Provide NEMA 3R enclosure in exterior or damp locations, unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR STARTERS:

- A. Install motor starters as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Install fuses in fusible disconnects, if any. Mount chart inside each starter indicating heater type, size, and ampere ratings available.
- C. Electrical Identification: Refer to Section 260553 for requirements.

3.2 ADJUST AND CLEAN:

- A. Inspect operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finish.

3.3 FIELD QUALITY CONTROL:

- A. Subsequent to wire/cable hook-up, energize motor starters and demonstrate functioning of equipment in accordance with requirements.

END OF SECTION 26 2913

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SECTION 26 3213 - EMERGENCY ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of emergency electrical system work is indicated by drawings and schedules.
- B. Types of emergency system components specified in this section include the following:
 - 1. Automatic Transfer Switches (ATS)
 - 2. Emergency Generators (Diesel)
 - 3. Exhaust and Fuel Systems
 - 4. Remote Annunciator Panels
- C. CONDUCTORS/CABLES, RACEWAYS, AND ELECTRICAL BOXES AND FITTINGS are specified in applicable Division-26 Basic Materials and Methods sections.
- D. Refer to other Division-26 sections as applicable for work required in connection with emergency electrical systems.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to wiring methods, materials, construction and installation of emergency electrical systems. Comply with applicable requirements of UL 924, "Emergency Lighting and Power Equipment" and UL 1008, "Automatic Transfer Switches". Provide system components, that are UL-listed and labeled.
- B. Comply with applicable requirements of NFPA Nos. 37, (99), 101, and 110 pertaining to stationary combustion engines, (health care facilities), life safety code, and emergency and standby power supplies.
- C. Comply with ANSI/NEMA Std. Pub. No. ICS 2, pertaining to AC automatic transfer switches. Comply with applicable requirements of ANSI/NEMA MG 1, "Motors and Generators", and MG 2, "Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators". Comply with applicable portions of IEEE Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to standby power.

1.4 SUBMITTALS:

- A. Refer to Section 260502 for electrical submittal requirements.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Provide emergency electrical systems and components, of types, ratings, and electrical characteristics indicated. Provide all system components thru one supplier to guarantee

total system responsibility. Provide system and components capable of start and load transfer within 10 seconds of power outage.

2.2 ENVIRONMENTAL CONDITIONS:

- A. Provide system components and accessories as required to ensure proper system operation at rated capacities under the following environmental conditions:
1. Altitude: 4800 feet above sea level
 2. Maximum ambient temperature: 50 degrees C.
 3. Minimum ambient temperature: 0 degrees C.
 4. Seismic Zone as indicated in General Structural Notes.

2.3 AUTOMATIC TRANSFER SWITCHES:

- A. Provide contactor type automatic transfer switches compatible with electric sets, and of continuous ampere rating sufficient to meet requirements of both maximum set output and normal power service. Switches that employ interlocking handles and circuit breakers to affect transfer are not acceptable. Provide 4 pole switches where distribution system is provided with ground fault protective relaying, or where indicated on drawings. Provide switches of voltage and phase indicated, and with the following features and characteristics:
1. Provide precision calibrated voltage sensors to monitor the normal power source and signal the electric set to start on a partial loss of power on any phase or where feedback voltages exist. Provide adjustability to signal start-up when line voltage drops 5 percent to 20 percent below pick-up voltage setting, and to signal shutdown when line voltage returns to 75% to 100% of normal.
 2. Provide a time delay relay, adjustable from 1 to 10 seconds, to delay the signal to start to avoid nuisance start ups on momentary voltage dips or power outages.
 3. Provide voltage sensors to sense return of normal power; and a time delay, adjustable 2 to 60 minutes, to delay the retransfer of load to normal to avoid short term fluctuations in normal power restoration.
 4. Provide an engine cool-down timer, adjustable from 0 to 5 minutes, for unloaded engine cool-down time. Timer shall engage after retransfer to normal.
 5. Provide pilot light to indicate switch in normal position and pilot light to indicate switch in emergency position. Mount pilot lights in front face of enclosure.
 6. Obtain operating current for transfer and retransfer from the source that the load is to be transferred. Provide automatic bypass to retransfer the load from the electric set to the normal source if the electrical set output interrupts after normal source restores voltage.
 7. Provide switch to simulate an interruption of power from the normal source.
 8. Provide manual operator with removable handle for manual operation of the switch.
 9. Provide clock exerciser to automatically start the electrical set at regular intervals and allow it to run for a preset time period; minimum of 30 minutes per week. Equip with selector switch to permit selection of "without load" or "with load" operation.
 10. Provide means to electrically disconnect the control section from the transfer switch for maintenance service during normal operation.
 11. Provide a battery charger mounted inside the transfer switch enclosure.

12. Provide time delay neutral position transfer in both directions to allow transfer switch to be disconnected from both sources during transfer from one source to another. Time delay shall be adjustable from 0 to 5 seconds.
 13. Provide (3) sets of N.O./N.C. auxiliary contacts (in addition to those for remote Ann. panel) that operate when the transfer switch is in the normal position.
 14. Provide (3) sets of N.O./N.C. auxiliary contacts (in addition to those for remote Ann. panel) that operate when the transfer switch is in the emergency position.
 15. Provide ammeter with 4-position selector switch marked "Off", "1", "2", and "3" to read current in all three phases of the load circuit.]
- B. **RATING AND PERFORMANCE:** Rate automatic transfer switch for continuous duty when enclosed in a non-ventilated NEMA 1 enclosure. Rate switch for all classes of load, both inductive and non-inductive, at 600 volts; and tungsten lamp load at 205 volts.
- C. Switch must be capable of closing into and withstanding fault current of 65,000 amperes RMS symmetrical at 600 volts, for units 225 amps and larger and 30,000 amperes RMS symmetrical on units 200 amps and less.
- D. **CONSTRUCTION:** Provide operating mechanism with sufficient mechanical and electrical interlocks to prevent simultaneous energizing both normal and standby service. Provide main contacts with arc suppression and heat dissipation devices to provide dependable transfer of highly inductive loads. Equip switch with terminal lugs for either copper or aluminum conductor.
- E. **ENCLOSURE:** Enclose switch in heavy gauge, welded seam construction, NEMA 1 enclosure.
- F. **MANUFACTURERS:** Subject to compliance with requirements, provide automatic transfer switches of one of the following:
1. ASCO, Inc.
 2. Onan Corp.
 3. Russelectric Co.
 4. Zenith Controls, Inc.
 5. Kohler Power System
 6. Generac

2.4 ENGINE GENERATOR UNITS:

- A. Provide 60 hertz alternating-current standby-diesel engine-driven generator units of voltage, phase and capacities indicated. Base rating of electric sets upon operation after deducting power required for output for all necessary operating accessories, (including remote or direct drive radiator fans, fuel pumps, etc.) and under environmental conditions specified. Provide electric sets rated and capable of producing KW specified at 0.8 power factor for continuous standby duty. Certify performance of the electric set series by means of independent testing laboratory tests for full power rating stability, and voltage and frequency regulation.
- B. Provide stationary, water cooled, full diesel, compression ignition, four stroke cycle, multi-cylinder, in-line or V-type engine. Arrange engine for direct connection to an alternator current generator; do not exceed engine speed of 1800 RPM at full rated load. Completely assemble engine, alternator, and components on a single base before shipping.
- C. **OVERCURRENT PROTECTIVE DEVICES:** Provide overcurrent protective devices mounted in generator enclosure to match ratings of overcurrent protective devices

providing service to normal power side of transfer switches.

- D. LUBRICATION SYSTEM: Equip engine with a pressure lubricating system. Provide spin-on type full flow lubricating oil filters. Equip filter with bypass valve to insure oil circulation if filters are clogged. Include dipstick oil level indicator. Provide lube oil heater for engine generator units located outdoors or where ambient temperature requires lube oil heating.
- E. ENGINE COOLING SYSTEM: Provide engine cooling system that operates fully automatically while the engine is running. The cooling system coolant shall use a combination of water and ethylene-glycol sufficient for freeze protection at the minimum winter outdoor ambient temperature of the application. All coolant pumps shall be centrifugal type. Each engine shall have an engine-driven primary pump.
- F. The engine cooling radiator shall be:
 - 1. Engine/skid mounted at the front of the mounting base. Provide coolant in accordance with manufacturer's recommendation.
- G. Equip engine with thermostatically controlled water jacket heater on all water cooled units. On air-cooled engines provide an oil base heater. The heater voltage shall match available voltage at the site. Make all necessary connections of jacket and oil base heaters.
- H. AIR CLEANER: Provide reusable element air cleaner of size and type recommended by the engine manufacturer.
- I. STARTING: Equip engine with a 12 volt electric starting motor of sufficient capacity to crank the engine at a speed that will allow full diesel starting of the engine. Disengage starter automatically when engine starts.
- J. Provide engine start-stop switch with functions including reset, run/start, stop and automatic mode. Provide adjustable cycle cranking and cool down operation.
- K. Provide rack mounted lead-acid battery set mounted integrally with electric set base. Provide sufficient capacity for cranking the engine a minimum of 4 cranking periods with 2-minute intervals between cranks. Each cranking period shall have a maximum duration of 15 seconds. Provide capacity and voltage recommended by engine manufacturer. Equip with all necessary interconnecting cables. Provide suitable float type battery charger to maintain the batteries in charged condition.
- L. BATTERY CHARGER: Provide suitable automatic SCR voltage regulated battery charger with a maximum charge rate, as recommended by the manufacturer, to maintain batteries at full capacity during standby conditions. Equip with ammeter to indicate charge rate and protect circuit by either fuses or circuit breakers. Design charger such that it will not be damaged during engine cranking.
- M. ENGINE INSTRUMENTS: Provide a unit mounted console with the following items:
 - 1. Lubricating oil pressure gauge
 - 2. Lubricating oil temperature display
 - 3. Coolant fluid inlet/outlet temperature display
 - 4. Coolant temperature gauge
 - 5. Run time meter
 - 6. Fuel meter display
 - 7. Tachometer display
 - 8. Battery charge rate ammeter
 - 9. Engine Start-stop switch

- N. EXHAUST SYSTEM: Provide a critical type exhaust silencer, flexible exhaust connector, and all exhaust piping and insulation as required. Flexible sections shall be made of convoluted seamless tube without joints or packing. Expansion joints shall be the bellow type. Expansion and flexible elements shall be stainless steel suitable for diesel-engine exhaust gas at 1000 degrees F.
 - O. Comply with manufacturer's recommendations. Wrap the entire exhaust system, from manifold to roof or wall penetration with exhaust insulation blankets as manufactured by Advanced Thermal Products, Inc., Santa Ana, California. Install per manufacturer's instructions.
 - P. ENGINE PROTECTION DEVICES: Provide the following engine protection devices with indicating light annunciation for each device:
 - 1. Low-oil pressure cut-out
 - 2. High air temperature cut-out
 - 3. Overspeed cut-out
 - Q. MOUNTING: Equip electric set with a suitable base for mounting on a level surface. Provide vibration isolators, rated for seismic zone specified herein, between the electric set and base. Concrete base shall be designed by a Structural Engineer. All costs arising from design shall be paid by Manufacturer.
 - R. FUEL: Provide engine capable of satisfactory performance on commercial grade diesel fuel as recommended by manufacturer.
 - S. GOVERNOR: Equip engine with a high performance isochronous electronic governor to maintain frequency within the limits, as specified below by controlling engine and alternator speed.
 - 1. Stability: + or - 0.33 percent at rated load
 - 2. Speed Regulation: 5 percent maximum load to rated load
 - T. The governor shall be configured for safe manual adjustment during operation of the engine-generator from 90 to 110 percent of rated frequency.
- 2.5 FUEL SYSTEM:
- A. Equip engine with primary and secondary fuel filters with replaceable elements, and an engine driven fuel pump, all mounted on the engine. Provide fuel system piping of size and type recommended by the engine manufacturer. Provide fuel tank(s) as follow(s):
 - 1. Provide fuel tank, sufficient for 24 hours operation at full load, mounted between generator support rails. Provide a secondary containment tank.
- 2.6 ELECTRIC ALTERNATOR:
- A. Provide direct connected, engine driven, single bearing, synchronous type alternator with electrical characteristics indicated.
 - B. INSTANTANEOUS VOLTAGE DIP: Limit voltage dip of engine generator set to less than 30 percent upon application of full rated power. Accomplish voltage regulation by means of a solid state voltage regulator. Inherently regulated machines are acceptable in sizes under 6KW.
 - C. Stability: 1 percent of its mean value at any constant load from no load to full load for solid state regulators.
 - D. Regulation: Plus or minus 2 percent maximum no load to full load for solid state regulators.

- E. Where more than 40 percent of the load is comprised of rectifiers and/or thyristors, provide power to voltage regulator by means of ceramic type permanent magnet pilot excitor, capable of 80 percent automatic controlled SCR/Thyristor loading.
- F. Provide instrument panel and console with the following:
 - 1. Manual reset circuit breaker
 - 2. A.C. voltmeter
 - 3. A.C. ammeter
 - 4. Voltmeter-ammeter phase selector switch with "off" position
 - 5. Frequency meter
 - 6. Start-Stop switch
 - 7. Remote start terminals
 - 8. Solid state cycle cranking control
 - 9. Engine safety alarm lights and contact
 - 10. Provide automatic solid state overload protection, under frequency protection, and volts/hertz characteristics.

2.7 EMERGENCY POWER OFF (EPO):

- A. The emergency generator shall be provided with a remote EPO (similar to a break glass station) located outside of the room housing the generator.

2.8 WEATHERPROOF ENCLOSURE:

- A. Provide weatherproof enclosure for engine generator unit. Enclosure shall house all components including engine, alternator, batteries, battery charger, fuel tank and controls. Provide one piece roof with drip edge on all four sides and with formed roof stiffeners to support silencer. Provide angle iron frame around the entire bottom of the enclosure to attach to mounting surface. Provide doors on each side for access to engine, alternator and all components. Provide all doors with continuous piano type hinges with stainless steel pins. Provide lockable 2-point latches on all doors, keyed alike. Provide a welded fixed open air intake louver panel on each side to accomplish air intake. Provide a framed expanded metal core guard to accomplish air discharge. Assemble all components with plated bolts and nuts. Caulk all seams to prevent rust bleed through. Clean and paint all components with manufacturer's standard rust inhibiting primer. Provide finish coat paint color to match pad mounted transformer. All openings shall be provided with screen material to exclude entrance of rodents.

2.9 SAFETY SYSTEM AND REMOTE ANNUNCIATOR:

- A. Provide all wiring, devices, equipment, and components to automatically activate the appropriate signals and initiate the appropriate annunciation as specified herein.
- B. Provide remote annunciator panel in flush enclosure (locate as directed by Owner/Architect or as indicated on drawings) with the features specified and with audible and visual alarm indication of the following conditions:
 - 1. Low engine temperature (engine heater not functioning).
 - 2. High temperature prealarm - engine temperature approaching shut down.
 - 3. Low oil pressure prealarm - engine oil pressure approaching shut down.
 - 4. Unit shut down due to low oil pressure.

5. Unit shut down due to high temperature.
 6. Unit shut down due to overcrank.
 7. Unit shut down due to overspeed.
 8. Emergency (or normal) power source supplying load.
 9. Battery charger malfunction.
 10. Low fuel - main tank contains less than a 3 hour supply.
 11. Low battery voltage.
 12. System ready no alarm conditions present, all controls in "automatic".
 13. Audible alarm silence push button.
- C. MANUFACTURER: Subject to compliance with requirements, provide engine-driven generator sets of one of the following:
1. Caterpillar Tractor Co.
 2. Cummins Engine Co.
 3. Kohler Co.
 4. Generac

PART 3 – EXECUTION

3.1 INSTALLATION OF ENGINE-GENERATOR SYSTEMS:

- A. Install standby engine-generator sets as indicated, in accordance with the equipment manufacturer's written instructions, and with recognized industry practices, to ensure that engine-generator sets fulfill requirements. Comply with NFPA and NEMA standards pertaining to installation of standby engine-generator systems and accessories.
- B. Provide vibration isolation mounting and anchoring of generator set to concrete slab.
- C. Install fuel oil and piping to standby generator equipment. Comply with manufacturer's instructions and recommendations.
- D. Provide engine lubricating oil, fuel, engine coolant, filters, etc. for system testing. After testing, refill all fluids to capacity (including all fuel tanks furnished under this contract) for final acceptance.
- E. Fire Protected Circuits:
 1. Provide protected circuits for emergency feeders for the following occupancies:
 - a. Educational occupancies with more than 300 occupants.
 2. Feeders shall be protected by one of the following. Electrical contractor shall be responsible for meeting one of the following methods:
 - a. Feeder is protected by a listed assembly with a minimum 2 hour fire rating.
 - b. Feeder is listed a fire-resistive cable assembly.
 - c. Feeder is encased in a minimum of 2" concrete.
- F. Electrical Identification: Refer to Section 260553 for requirements.

3.2 GROUNDING:

- A. Provide equipment grounding connections for system components.

3.3 TESTING:

- A. Upon completion of installation of engine-generator system and after building circuitry has been energized with normal power source, (including all VFD's and other motor starters), test engine-generator to demonstrate standby capability and compliance with requirements. Provide start-up and testing by factory authorized representative in accordance with manufacturer's recommendations. Perform each of the following tests (as a minimum) and submit written report of results of each as part of the Operation and Maintenance Manuals required herein:
1. Mimic a normal power outage by de-energizing normal power source to the facility. Verify engine start, transfer, and operation of all loads satisfactorily. Re-energize normal power, and verify proper performance of load retransfer, engine cool down, and engine shut down. Record and report all results.
 2. Mimic a generator test by operating the "test mode" switch (with facility still energized by normal power). Verify engine start, transfer, and operation of all loads satisfactorily. Return "test" switch to normal, and monitor performance of load retransfer, engine cool down, and engine shut down. Record and report all results.
 3. Perform a safety run test in accordance with the following:
 - a. Provide all fluids, equipment, and test instrumentation to perform complete tests.
 - b. Perform and record all engine manufacturer's recommended pre-starting checks and inspections.
 - c. Verify the proper operation of all controls, gauges, instruments, and set points.
 - d. Verify the proper operation of the emergency stop switch, the over-speed limit switch, oil overfill limit, oil low limit, and the over- and under-frequency limits. Where digital controls prevent direct access to safety switches, the manufacturer's representative shall utilize a field service computer and manufacturer's field service software to demonstrate the control's monitoring of engine speed, oil pressure and coolant temperature.
 - e. Perform an engine load run test. Provide all fluids, equipment, load banks, and test instrumentation to perform complete tests.
 4. Perform and record all engine manufacturer's recommended prestarting checks and inspections.
 5. Tests:
 - a. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection, except those indicated to be optional, for "AC Generators and for Emergency Systems" specified in NETA acceptance testing specification. Certify compliance with specification parameters.
 - b. Continuous engine load run test:
 - i. Provide a resistance load bank and make temporary connections for full load test.
 - ii. Readings shall be taken at 15 minute intervals shall include the following:

1. Output amperes, voltage, real and reactive power, power factor and frequency.
 2. Lube-oil pressure.
 3. Coolant, lube-oil, exhaust, and ambient temperatures.
 - iii. Operative the engine generator set for 4 hours at 100% of rated load.
 - iv. Remove load from the engine generator set. Shut down the engine generator set.
 6. Perform tests required by NFPA 110 acceptance tests that are additional to those specified here including, but not limited to, a “cold start” test and a one step rated load pickup test. The AHJ (Authority Having Jurisdiction) shall be notified in advance and shall have the option to witness the tests.
 7. Inspect lube oil filter for excessive metal, abrasive foreign particles, etc. If corrective action is necessary, perform all above run tests again after corrections have been made. Check all engine and mounting bolts for tightness and/or visible damage. Inspect and verify engine-generator shaft alignment by means of dial indicator.
 - B. After completion of all tests, provide engine fluid and diesel fuel to refill all engine fluids and refill diesel fuel tank to capacity.
- 3.4 SURGE PROTECTIVE DEVICES:
 - A. Provide a surge protective device on each switchboard and panelboard located on the emergency distribution system. Refer to section 26 4313 for requirements.
- 3.5 ON SITE TRAINING:
 - A. Conduct a training course for operating staff as designated by the Owner. The training period shall consist of a total of 8 hours of normal working time distributed between two shifts, and shall start after the system is functionally complete but prior to final acceptance. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment as well as all major elements of the operation and maintenance manuals. Additionally, the course instruction shall demonstrate all routine maintenance operations such as oil change, oil filter change, air filter change, etc.
- 3.6 FIELD ENGINEER:
 - A. Provide a qualified field engineer to supervise the installation of the engine generator set, transfer, etc., assist in the performance of the on-site tests, and instruct personnel as to the operational and maintenance features of the equipment.
- 3.7 SERVICE AND SUPPORT
 - A. The manufacturer of the generator set shall maintain service parts inventory at a central location that is accessible to the service location 24 hours per day, 365 days per year.
 - B. The generator set shall be serviced by the local service organization (during the warranty period) that is trained and factory certified in generator set service the supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

END OF SECTION 26 3213

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SECTION 26 3533 - POWER FACTOR CORRECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of power factor correction work is indicated by these specifications. Work includes complete installation and electrical connections.
- B. Types of power factor correction equipment in this section include the following:
 - 1. Corrective capacitors

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to location and installation of power factor correction capacitors and ancillary equipment. Comply with requirements for ANSI/NEMA Std. Pub. No. ICS 2 pertaining to power factor correction capacitors. Comply with UL 810; "Capacitors". Provide power factor correction capacitors that are UL listed and labeled.

1.4 SUBMITTALS: Refer to Section 26 0503 for requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following:
 - 1. General Electric Co.
 - 2. Eaton Corporation
 - 3. Square D Schneider Electric

2.2 POWER FACTOR CORRECTION CAPACITORS:

- A. GENERAL: Provide power factor correction capacitors and ancillary components; complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation and as herein specified.
- B. CAPACITORS: Provide factory-assembled power factor correction capacitors; of types, sizes, ratings, and electrical characteristics specified. Construct of internally fused, individually replaceable, unit cells enclosed in protective enclosure. Provide capacitors with discharge resistors that reduce voltage to 50 volts or less within 1 minute after capacitors are disconnected. Construct single-case housings of welded heavy gage steel with capability of being ganged for multiple-bank installation, and equip with solderless connecting terminal lugs. Provide with non-flammable impregnant for operating over ambient temperature ranges of minus 40 degrees F (-40 degrees C) to 104 degrees F (40 degrees C).
- C. Provide power factor correction capacitors for all motors rated 3HP and larger and which

are not powered by a VFD. Provide capacitors in ratings according to motor horsepower per the following table:

Induction Motor HP Rating	1800 RPM Capacitor kvar
3	1.5
5	2
7.5	2.5
10	3
15	4
20	5
25	6
30	7
40	9
50	10
60	15
75	17.5

- D. MOUNTING: Mount capacitors adjacent to motors, adjacent to individual motor starters, or where motor control centers are provided, within the motor control centers adjacent to the respective motor starter compartments. Provide all necessary bus work, connectors, frames, racks, etc., necessary for properly installed and secured capacitor. Connect capacitors to the load side of the motor starter overloads.

PART 3 - EXECUTION

3.1 INSTALLATION OF POWER FACTOR CORRECTION CAPACITORS:

- A. Install power factor correction capacitors in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that capacitors comply with requirements.

3.2 GROUNDING:

- A. Provide tight equipment grounding connections for capacitors.

3.3 FIELD QUALITY CONTROL:

- A. Subsequent to completion of installation of capacitors, energize capacitors and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 26 3533

SECTION 26 4119 - DEMOLITION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Special Provisions, Division 1 and Division-2 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to demolition.

1.2 DESCRIPTION OF WORK:

- A. Extent of major items of demolition work is indicated by drawings. Other demolition work shall be performed as required to maintain system operation.
- B. The intent of the drawings is to indicate major items affected and not to show every device, outlet, fixture, etc. affected by demolition work.
- C. The drawings do not necessarily reflect as-built conditions. The contractor shall visit the jobsite prior to bidding to determine the overall scope of demolition work.
- D. Refer to sections of other Divisions for applicable requirements affecting demolition work.
- E. Refer to Section 260500 for requirements with regard to power outages affecting the operation of existing electrical systems.

1.3 QUALITY ASSURANCE:

A. NEC COMPLIANCE:

- 1. Comply with applicable portions of NEC as to methods used for demolition work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL:

- A. Demolition work shall be laid out in advance to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary, perform with care, use skilled mechanics of the trades involved. Repair damage to building and equipment. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting of structural members shall not be permitted.

3.2 PATCHING AND REPAIR

- A. The Contractor is responsible for all demolition, patching and repair of all finished interior surfaces pertaining to the installation of this particular phase of work. All surfaces shall be finished (painted, etc.) to match the adjacent materials, finishes and colors.
- B. Hard surfaces: Whenever demolition or excavation is required for the installation of the electrical system, it shall be the responsibility of this contractor to make repairs and/or replacements of hard finish surfaces such as concrete, asphalt, roofing, etc.
- C. The method of patching and repair shall follow good construction practices and all finished surfaces shall match materials and finish wherein the demolition occurred.

3.3 EXISTING EQUIPMENT

- A. The following is a part of this project and all costs pertaining thereto shall be included in the base bid.
- B. The new electrical equipment and apparatus shall be coordinated and connected into the existing system as required. Auxiliary systems shall comply, unless otherwise specified.
- C. The existing electrical devices, conduit and/or equipment that for any reason obstructs construction shall be relocated. Provide conduit, wiring, junction boxes, etc. as required to extend existing circuits and systems to relocated devices or equipment.
- D. The new fixtures indicated for existing outlets shall be installed in accordance with the fixture specifications.
- E. When installing equipment in the existing building, it shall be concealed.
- F. All existing electrical equipment and systems in portions of the building not being remodeled shall be kept operational, in service and in working condition throughout the entire construction period. Restore any circuits and systems interrupted. Provide temporary panels, temporary wiring and conduit, etc. as required.
- G. Maintain circuit integrity and continuity of all existing circuits and systems that interfere with or are interrupted by remodel work unless those circuits are to be abandoned completely. Maintain all circuits and systems in operation during construction. Provide temporary panels, temporary wiring and conduit, etc. as required.
- H. Existing raceways may be used where possible in place, except as noted. All circuits, conduit and wire that are not used in the remodeled area shall be removed back to the panelboard, where it shall be labeled a spare with circuit number indicated. Re-used raceway shall meet all requirements for new installations.
- I. Obtain permission from the Architect and Owner's representative before penetrating any ceiling, floor, and wall surfaces.
- J. Any and all equipment having electrical connections that require disconnecting and reconnection at the same or another location throughout the course of construction shall be included as part of this contract.

END OF SECTION 26 4119

SECTION 26 4313 - SURGE PROTECTIVE DEVICES (SPD)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division 26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of SPD's work is indicated by drawings, schedules and specified herein. Work includes complete installation, electrical connections, testing, and commissioning.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC, NEMA and IEEE Standards as applicable to wiring methods, construction and installation of SPD's. Comply with applicable requirements of ANSI/IEEE C62.11, C62.41.2 and C62.45; NFPA 70 285 (Type 2), 75, and 78; and ANSI/UL 1449 4th edition. Provide complete packaged units that have been listed and labeled by Underwriters Laboratory. UL surge ratings (UL 1449) must be permanently affixed to the SPS's device.

1.4 SUBMITTALS: Refer to Section 26 0503 for requirements.

PART 2 - PRODUCTS:

2.1 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide products manufactured by one of the following as indicated by "Location Category" herein.
 - 1. Advanced Protection Technologies Inc.
 - 2. Current Technology Inc.
 - 3. Cutler Hammer, Inc.
 - 4. L.E.A. International
 - 5. Emerson Network Power Surge Protection Inc.
 - 6. United Power Corporation
 - 7. GE
 - 8. Eaton
 - 9. Surgelogic (Square D)
 - 10. Siemens Energy & Automation, Inc.

2.2 GENERAL:

- A. Except as otherwise indicated, provide high energy surge protective devices, with high frequency line noise filtering, suitable for application in Category A, B, and C environments as indicated. Provide types, sizes, ratings and electrical characteristics indicated that comply with manufacturer's standard materials, design, and construction in accordance with published information and as required for a complete installation.

2.3 VOLTAGE SURGE SUPPRESSION – GENERAL:

A. Electrical Requirements

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

Configuration	Protection Modes			
	L-N	L-G	L-L	N-G
Wye	•	•	•	•
Delta	N/A	•	•	N/A
Single Split Phase	•	•	•	•
High Leg Delta	•	•	•	•

5. Nominal Discharge Current (In) – All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.
6. ANSI/UL 1449 4th Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:

B. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be

soldered, hardwired with connections utilizing low impedance conductors.

5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
 - a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
 - i. For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
 - ii. For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
 - iii. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
 - b. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
 - c. Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
 - d. Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of $50 \pm 20A$ occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
 - i. The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored.

The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection
 - a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
7. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.
8. Safety Requirements
 - a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
 - b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.
 - c. Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.4 SYSTEM APPLICATION

- A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
- B. Provide a surge protective device on each switchboard and panelboard located on the emergency distribution system. Refer to table below for category type.

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
CATEGORY	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

- C. Surge Current Capacity – The minimum surge current capacity the device is capable of

withstanding shall be as shown in the following table:

- D. SPD Type – all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.5 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

- A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
 - 1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
 - 2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
 - 3. The panelboard shall be capable of re-energizing upon removal of the SPD.
 - 4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
 - 5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
 - 6. The SPD shall be of the same manufacturer as the panelboard.
 - 7. The complete panelboard including the SPD shall be UL67 listed.
- B. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly)
 - 1. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.
- C. Switchgear, Switchboard, MCC and Busway Requirements
 - 1. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
 - 2. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, and busway
 - 3. The SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer
 - 4. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
 - 5. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
 - 6. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a

factory standardized design.

7. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.6 ENCLOSURES

- A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:
 1. NEMA 1 – Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
 2. NEMA 4 – Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure. (sidemount units only)
 3. NEMA 4X – Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install SPD's as indicated in accordance with manufacturers recommendations and as necessary to meet requirements. Install with conductors of minimum length practicable, but in no case exceeding 30" in length; minimum conductor size - #8 AWG copper.
- B. Install conductors in straight runs with a minimum of turns or bends (minimum bend radius to be 90 degrees). Do not splice phase or ground conductors in SPD's circuit. Torque all conductor terminations in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL:

- A. Upon completion of installation of equipment, energize and demonstrate capability and compliance with requirements. Remove malfunctioning units, replace with new units and proceed with retesting.

END OF SECTION 26 4313

SECTION 26 5100 - INTERIOR AND EXTERIOR BUILDING LIGHTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Types of lighting fixtures in this section are indicated by schedule and include the following:
 - 1. LED (Light Emitting Diode)

1.3 QUALITY ASSURANCE:

- A. Comply with NEC, NEMA and ANSI 132,1 as applicable to installation and construction of lighting fixtures. Provide lighting fixtures that have been UL-listed and labeled.
- B. Components and fixtures shall be listed and approved for the intended use by a National Recognized Testing Laboratory (NRTL) including: UL, ETL, and CSA or equivalent
- C. All led products shall comply with the latest version of Illuminating Engineer Society (IES) publications LM-79 and LM-80.

1.4 SUBMITTALS: Refer to Section 26 0503 for requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide products of one of the following (for each type of fixture):
 - 1. LED:
 - a. Cree
 - b. Nichia
 - c. Samsung
 - d. Philips Lumiled
 - e. Osram
 - f. Xicato

2.2 INTERIOR AND EXTERIOR LIGHTING FIXTURES:

A. GENERAL:

- 1. Provide lighting fixtures, of sizes, types and ratings indicated complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, LED drivers, starters, and wiring. Label each fixture with manufacturer's name and catalog number. Provide all enclosed fixtures with positive latch mechanisms; spring tension clips not acceptable. Provide all exterior fixtures with damp or wet location label as required by application.

B. SUPPORT REQUIREMENTS:

1. Provide all pendant and stem hung fixtures with flexible ball joint hangers at all points of support. Equip hooks used to hang fixtures with safety latches. Provide all detachable fixture parts, luminous ceiling accessories, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chain, or safety cable.

C. LIGHT EMITTING DIODE (LED) LUMINAIRES:

1. LED luminaires that can be serviced in place shall have a disconnecting means internal to the luminaries to disconnect simultaneously from the source of supply all conductors of the driver, including the grounded conductor. Disconnects shall not be required under the following exceptions:
 - a. Luminaries located in hazardous locations.
 - b. Luminaries used for egress lighting.
 - c. Cord-and-plug luminaries.
 - d. In industrial establishments with restricted public access where conditions of maintenance and supervision ensure that only qualified persons service the installation.
 - e. Where more than one luminaire is installed in a space and where disconnecting the supply conductors to the luminaire will not leave the space in total darkness.
 - f. Provide LED luminaires which are tested in accordance with IES LM-79, diodes tested in accordance with IES LM-80, and provide a minimum R9 rating of ≥ 50 (unless specified differently), a CRI rating of ≥ 80 and L70 (6K) = 50,000 hours (IES TM-21). Provide with 0-10V dimming drivers as standard.
 - g. The fixture manufacturer(s) shall warrant the luminaires, in their entirety, to be free from defects in material or workmanship for at least 5 years from date of manufacture. Provide warranty in accordance with other sections of this specification and include a certificate of warranty from the fixture manufacturer with extended warranty information and proper forms and procedure description.

D. DIFFUSERS:

1. Where plastic diffusers are specified, provide 100 percent virgin acrylic compound; minimum thickness, .125 inches.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

- A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standards of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
- B. Coordinate with other work as appropriate to properly interface installation of lighting fixtures with other work. Consult architectural reflected ceiling plan for exact location of all lighting fixtures.
- C. Provide all necessary supports, brackets, and miscellaneous equipment for mounting of fixtures. Support all ceiling mounted fixtures from the building structure; independent of the ceiling system, unless noted. Support each recessed fixture (fluorescent

incandescent, and/or HID) from the building structure with #12 ga. steel wire attached to each corner (in addition to supports normally provided for attachment to the ceiling system). Provide backing supports above (or behind) sheetrock, plaster and similar ceiling and wall materials. Support surface mounted ceiling fixtures from channel. Support ceiling mounted outlet boxes independent of the raceway system, and capable of supporting 200 pounds. Feed each recessed fixture directly from an outlet box with flex conduit as required; do not loop from fixture to fixture. See plans for additional details.

D. FIXTURE WHIPS:

1. Provide each lay-in light fixture with at least 36" (Not to exceed 72") of 3/8" steel flexible conduit.
2. With-in spaces utilizing 0-10v control schemes ie: Room Controllers, the fixture whip shall be comprised of a MC-PCS Cable (see Section 26 0532 Conduit raceways) with at least 36" and not to exceed 72" in length located above removable grid ceilings.

E. Coordinate lighting in mechanical room with duct and equipment locations to avoid obstruction of illumination.

F. Provide gypsum board protection as required, (acceptable to fire official having jurisdiction) to ensure fire rating of each ceiling that the fixtures are installed in.

G. COORDINATION MEETINGS:

1. Meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each light fixture mounting condition with ceiling type. During second meeting, coordinate fixture layout in each area.
2. Meet at least once with the mechanical installer prior to fabrication and installation of duct work. Coordinate depth and location of all fixtures and duct work in all areas.

H. ADJUST AND CLEAN:

1. Clean lighting fixtures of dirt and debris upon completion of installation.
2. Protect installed fixtures from damage during remainder of construction period. Repair all nicks and scratches to appearance of original finish.

3.2 FIELD QUALITY CONTROL:

- A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements.
- B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units, and proceed with retesting.
- C. At the time of Substantial Completion, replace lamps in interior lighting fixtures that are observed to be noticeably dimmed after the Contractor's use and testing, as judged by Architect/Engineer.

D. GROUNDING:

1. Provide equipment grounding connections for each lighting fixture.

END OF SECTION 26 5100

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SECTION 26 5600 - EXTERIOR AREA LIGHTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Types of lighting fixtures in this section are indicated by schedule and include the following:
 - 1. LED (Light Emitting Diode)
- B. Excavation and backfilling for exterior area lighting poles, standards and foundations are specified in applicable Division-26 general provision sections.
- C. Concrete for embedding poles, and for pole foundations and footings is specified in other sections of specification. Provide pole bases under this section of the specification.
- D. Refer to other Division-26 sections for cable, wire and connectors required in connection with exterior area lighting poles and standards.
- E. Coordinate with South Jordan City for street lighting requirements. Coordinate with the latest street lighting standards and specifications.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC, NEMA and ANSI/IES requirements as applicable to location and installation of lighting poles and standards. Provide lighting components and fittings that are UL-listed and labeled.
- B. Comply with other portions of specification as applicable for forming, splicing, and curing of concrete bases provided under this section.

1.4 SUBMITTALS: Refer to Section 26 0503 for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER: Subject to compliance with requirements, provide products as scheduled on drawings.

- A. FUSES: Refer to Section 26 0503 for requirements.
- B. CONCRETE: 3000 psi Class.
- C. LIGHT FIXTURE POLES: Provide light fixture poles that comply with the following minimum requirements.
 - 1. The pole shaft constructed of seamless aluminum alloy per requirements of ASTM B221. Include a flush covered hand hole in each pole with finish hardware. Provide a permanent marking with the manufacturer name inside the hand hole for easy recognition.
 - 2. Provide aluminum alloy anchor base welded to the pole shaft. Welding must comply with AWS Specification D1.2, Structural Welding Code – Aluminum. The

complete assembly must be heat-treated to a T6 temper.

3. Provide super durable thermosetting polyester power coat paint, a minimum of 1.5 mils thick along the entire length of the pole.
4. Include aluminum nut covers for a "Shoe Base" trim.
5. Provide a 10 year minimum guarantee, which covers the pole structure and paint.
6. Provide vibration dampening in poles.
7. Refer to diagrams for specification of street lighting lights, poles and concrete bases. Verify category and all requirements with South Jordan City.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install area lighting units as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NESC and NEMA standards and with recognized industry practices to ensure that lighting units fulfill requirements.
- B. Coordinate with other work as necessary to properly interface installation of roadway and parking area lighting with other work.
- C. Comply with NEC 300-5 (or State of Utah requirement, whichever is most stringent), for raceway burial depth.
- D. Mount lighting units on concrete bases as indicated, complete with anchor bolts and reinforcing bars. Coordinate proper size and location of all bases as required to ensure proper installation. Provide 3000 psi class concrete; hand rub all exposed concrete to uniform, smooth finish.
- E. Deliver poles to job site with factory finish paint.
- F. Set poles and standards plumb. Support adequately during backfilling, or anchoring to foundations.
- G. Provide sufficient space encompassing hand access and cable entrance holes for installation of underground cabling.
- H. Provide Bussman HEB fuseholder (or Littelfuse LEB-XX-S) with "breakaway" receptacles in all conductors running to the top of each pole. Locate fuseholder at hand hole or in base junction box as applicable. Provide KTK fuses in each phase conductor, sized 1.5 times maximum full load current of ballasts served by each conductor. Do not exceed rating of circuit overcurrent protective device. Provide fuse blanks in neutral conductors. Make up all other splices in pole or pole base using Scotchcast 400 Resin for watertight connection.

3.2 STREET LIGHTING INSTALLATION:

- A. Verify all street lighting standards with South Jordan City. Verify all of their latest standards and requirements.
- B. Street lighting voltage is 120 volt input voltage (nominal).
- C. Verify that the size of the wire is sufficient for no more than 3% drop in normal voltage at the base of each pole, with respect to the actual distance of the conductor. The minimum allowed wire size is #6 AWG THHN copper wire from the power source.
- D. Provide #10 THHN copper from the hand hole to the fixture head in each pole.

- E. Color code wiring black, white and green.
- F. For the power feed, run conduit to the lock side of the transformer. Leave 8 feet of excess wire the transformer or 6 feet excess wire to a secondary box as directed by Rocky Mountain Power (RMP). If HDPE conduit is used, it must meet all South Jordan City requirements and NEC 353 and UL labeled and listed.
- G. Provide all conduit PVC schedule 40 gray in color, minimum 1 ½" (2" to the transformer). Size larger if re larger wire is required.
- H. Provide 90 degree bends with a maximum of 24 inch radius and minimum of 18 inch radius.
- I. Provide all conduits with approved cap or duct seal, a pull string and minimum of 24" cover in the trench (maximum 30 inches).
- J. Extend conduit a minimum of 1 inch and maximum of 3 inches above the finished streetlight concrete base.
- K. Maximum number of bends between ground boxes and light poles is 360 degrees.
- L. Provide ground boxes (box, vault, pull box, enclosure, junction box) grey in color with the words "South Jordan City Electric" on the plastic lid. Secure lid with stainless steel bolts and ant-freeze lubricant.
- M. Provide 6 inches of gravel (3/4 minus) for setting of the box, with the top of the box placed at finish grade. Extend conduit 2-3 inches above the gravel in the box, with the wire extending 18 inches above grade.
- N. Provide one ground box within 4 feet of the RMP source with 8'X5/8" copper ground rod in POC ground box.
- O. Provide wire nuts that are "wet location installation", with silicone in the pole base only.
- P. Provide Littlefuse LEBJJ fuse holder (or equivalent) with weatherproof rubber boot, mechanical connection, rated 600 volts, 30 amps. Provide 10 amp time delay F.N.Q. and 30 amp fuse required in POC ground box.
- Q. No crimp or split bolt connections are allowed.
- R. Provide grounding per NEC 250 and UL labeled and listed.
- S. Refer to NEC 250.24 for non-metered street lights.
- T. Coordinate with South Jordan City for requirement of third party testing.
- U. Secure ground wire to ground rods with 5/8 inch CU clad clamp.
- V. Provide Burndy KA25U 14- 1/0 AWG AL/CU mechanical lugs or equivalent to connect the ground wire to ground clip inside the poles.
- W. Provide the ground rod 2-3 inches above ethe finish concrete for the lighting base.

3.3 GROUNDING:

- A. Provide equipment grounding connections for each lighting unit installation.

END OF SECTION 26 5600

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SECTION 26 9000 - SYSTEM COMMISSIONING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Architectural, Structural, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full.
- C. Refer specifically to Section 01810 and Section 01815 for responsibilities to aid a commissioning agent.

1.2 DESCRIPTION OF WORK:

- A. System commissioning is not part of division 26, however will take place during construction. Division 26 contractor will be required to assist the commissioning agent with access to shop drawings and to various equipment required to be commissioned.
- B. The purpose of the commissioning process is to provide the Owner/operator of the facility with a high level of assurance that the electrical and associated electrical systems have been installed in the prescribed manner and operate within the performance guidelines set in the design intent. The Commissioning Authority (CxA) will provide the Owner with an unbiased, objective view of the system installation, operation, and performance. This process is not to take away or reduce the responsibility of the design professionals or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems to beneficial use by the owner. The CxA will be a member of the construction team, cooperating and coordinating all commissioning activities with the design professionals, construction manager, contractors, subcontractors, manufacturers, and equipment suppliers.
- C. The systems requiring commissioning are:
 - 1. Network Lighting Controls
 - 2. Occupancy Sensors
 - 3. Daylighting/Photocell Systems
 - 4. UPS Systems
 - 5. Cable Trays
 - 6. Fire Alarm Systems
 - 7. Overload Protected Devices
 - 8. Generators
 - 9. Automatic Transfer Systems
 - 10. Panelboards
 - 11. Lighting
 - 12. Local Lighting Controls
 - 13. Receptacles
 - 14. Transformers
 - 15. Raceways
 - 16. Switchgear
 - 17. Main Distribution Boards
 - 18. Switchboards
 - 19. Variable Frequency Drives

- 20. Metering Devices
- 21. Surge Protection Systems
- 22. Electrical Distribution
- 23. Motor Starters
- 24. Disconnects
- 25. Combination Starters

PART 2 – PRODUCTS: Not Used

PART 3 – EXECUTION: Not Used

END OF SECTION 26 9000

SECTION 27 1500 - TELEPHONE/DATA SYSTEMS

PART 1 – GENERAL

1.1 SCOPE OF DOCUMENT:

- A. The following are project specifications that all cabling systems must adhere to. These specifications apply to all installers (hereinafter referred to as “the Contractor”) for all sites, that require, standards-compliant structured cabling systems and shall be used for all the installation, testing, and acceptance of the information transport systems as described in the attached specifications. Prices quoted of the installation facilities shall be all-inclusive and represent a complete installation at such sites as prescribed in this specification and contract documents. The Contractor shall be solely responsible for all parts, labor, testing, acceptance and all other associated processes and physical apparatus necessary to turn-over a completed system fully warranted and operational for acceptance by the Customer. Final acceptance of the installation shall be in writing by the Architect and Engineer.
- B. In all instances where Standards are cited, it is assumed Installer will have familiarity with and implicitly follow the recommendations of the most current version of the Standard referenced at the time of installation. Compliance with most current Standards is the sole responsibility of the Contractor.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-7 Firestopping, apply to work of this section.
- C. Division-26 Basic Materials and Methods sections apply to work specified in this section.
- D. Refer to and coordinate with specification 27 4100 for any audiovisual equipment requiring UTP based category and/or optical fiber cabling and connectivity. Division 27 1500 shall provide installation and execution requirements for all category and/or optical fiber cabling and connectivity required within the audiovisual system.

1.3 SCOPE OF WORK:

- A. The extent of telephone/data system work is indicated by drawings and is hereby defined to include, but not be limited to racks, cabinets, patch panels, cables, raceway, outlet boxes, device plates, backboard, and grounding. Contractor is responsible for installation of all specified and unspecified necessary and miscellaneous items required for delivery of a complete and functional data cabling and device system.
- B. Contractor shall provide complete cable and outlet system as indicated on the drawings and described herein. Work shall include all associated infrastructure transmission components and support appliances including, but not be limited to cable, jacks, terminal blocks, racks, cabinets, wire management, labeling, transient voltage surge suppression, patch cords, telecommunications grounding system and all terminations as specified herein.
- C. Contractor shall provide system testing as described herein using up-to-date and industry accepted Level IIIe test equipment appropriate to the types of links being tested and in accordance with the latest edition of IEC 61935-1. All testers used shall be factory calibrated within one year of use with references set daily prior to testing.
- D. All active equipment (electronics) will be owner furnished and owner installed.

- E. Contractor shall be solely responsible for all parts, labor, testing, documentation and all other associated processes and physical apparatus necessary to turn-over the completed system fully warranted and operational for acceptance by Owner and Engineer.
- F. Contractor shall provide all labor, materials, tools and equipment required for the complete installation of work called for in the Construction Documents.
- G. Copper solution must match optical fiber solution and be provided by the same manufacturer. No two separate warranties are acceptable for the copper connectivity and optical fiber connectivity.
- H. Contractor shall provide 1-1" EMT conduit from telecommunications outlet/connector to accessible ceiling space, then utilize non-continuous cable support devices to EF/ER/TR/TE. Where spaces are open to structure and no ceiling exists, cables must be installed in conduit.
- I. Contractor to provide cabling for the Audio Video (AV), the Intercom System, Video Surveillance System and the Telecommunications System separately to patch panels. Each group shall be punched down to its own patch panel to ensure future system work can be completed without disrupting all systems.

1.4 CONTRACTOR QUALIFICATIONS

- A. The contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to voice and data network systems. The Contractor shall at a minimum possess the following qualifications:
 - 1. Must have at a minimum (1) RCDD certified individual employed full time at the time of bidding and throughout entire project. PROVIDE PROOF OF RCDD CERTIFICATION IMMEDIATELY UPON JOB AWARD.
 - 2. Approved and certified by connectivity manufacturer. Provide proof of certification immediately upon job award.
 - 3. BICSI Certified Installers or equivalent.
 - 4. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
 - 5. Have a minimum of 5 years in the communications structured cabling business and be able to provide three owner references for the type of installation described in this specification for projects within the last 18 months.
 - 6. Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must own not rent a light meter or fiber test adapter head, and OTDR and shall be factory certified by the manufacturer of the products being installed.
 - 7. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.
 - 8. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.
 - 9. Be factory certified by the manufacturer used in installation of all transmission components of all copper and fiber links and able to provide the manufacturer warranty.

1.5 QUALITY ASSURANCE

- A. Required Pre-Telecommunications Construction Meeting with Communications Engineer:

Electrical contractor/representative AND Communications Contractor will be required to attend a pre-communications construction meeting (approximately 30-60 minutes) with Communications representative in the electrical engineer's office prior to communications construction commencement. This meeting will address any questions on the part of the contractor and the expectations of the Engineer with regard to specifications, plans and site visits for both rough and finish electrical work.

- B. Owner IT Contact:
 - 1. Anthony Muto; anthony.muto@jordandistrict.org, (801) 567-8318
- C. BNA IT Contact:
 - 1. Drayton Bailey; drayton@bnaconsulting.com, 801-532-2196
 - 2. Josh Oakeson RCDD; josh@bnaconsulting.com, 801-532-2196
 - 3. Son Nguyen; snguyen@bnaconsulting.com, 801-532-2196

1.6 APPLICABLE CODES AND STANDARDS

- A. Contractor is responsible for compliance with all applicable portions of the NEC code as to type of products used and installation of components. All materials used shall be products and materials that have been UL-listed and labeled. All installed products shall comply with applicable NEMA standards for low loss extended frequency cable.
- B. In addition, installation shall adhere to the following Standards:
 - 1. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises, or most recent edition at the time of installation
 - 2. ANSI/TIA-568-C.1 - Commercial Building Telecommunications Cabling Standards, or most recent edition at the time of installation
 - 3. ANSI/TIA-568-C.2 - Balance Twisted Pair Communications and Components Standards, or most recent edition at the time of installation
 - 4. ANSI/TIA -942 -Telecommunications Infrastructure for Data Centers, or most recent edition at the time of installation
 - 5. TIA-569-B - Commercial Building Standard for Telecom Pathways and Spaces, or most recent edition at the time of installation
 - 6. ANSI/TIA-606-A - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, or most recent edition at the time of installation
 - 7. ANSI/NECA/BICSI-607 - Commercial Building Grounding/Bonding Requirements, or most recent edition at the time of installation
 - 8. ANSI/TIA 1152 - Testing of Copper Links
 - 9. BICSI Telecommunications Distribution Methods Manual, 13th edition or most recent edition at the time of installation.
 - 10. TIA 758-A - Customer owned Outside Plant Telecommunications Infrastructure Standard (2004), including all applicable addenda and the most recent revision at the time of installation.
 - 11. BICSI Information Transport Systems Installation Manual - 5th edition or most recent edition at the time of installation.
 - 12. ANSI/NFPA-70 - 2017 National Electrical Code, revision, or most recent revision at the time of installation.
 - 13. ANSI/IEEE C-2 - 2017 National Electrical Safety Code or most recent revision at the time of installation.
 - 14. OSHA Standards and Regulations All applicable
 - 15. Local Codes and Standards All applicable
- C. Note: Anywhere cabling standards conflict with electrical or safety codes, Contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most

stringent requirements listed by either. Knowledge and execution of applicable codes is the sole responsibility of the Installer. Any code violations shall be remedied at the Contractor's expense.

1.7 ACCEPTABLE MANUFACTURERS:

A. General:

1. Unapproved product substitutions are not allowed. Contractor wishing to substitute any products for those expressly specified shall submit three samples of the alternate product to Engineer no less than two weeks prior to the last addendum accompanied by all engineering documents, drawings and third party test data proving mechanical and transmission equivalency. Acceptance of substitutions shall be received from Engineer in writing. All unapproved substitutions installed shall be removed by Contractor who shall assume all costs for removal and replacement with approved products. Such costs shall include, but not be limited to labor, materials, as well as any penalties or fees for late completion.

B. APPROVED MANUFACTURERS:

1. Contractor shall select only one line item in the each section of Parts 2, 3, and 4. Contractor shall NOT utilize multiple line items for the project within each Part. For example, if Panduit / General Cable is selected to be used for the project, all copper cabling and connectivity shall be by Panduit or General Cable. No other manufacturer or combination of manufacturers may be used for the copper cabling or connectivity equipment.
2. Copper Cabling / Connectivity Approved Manufacturers:
 - a. CommScope
 - b. Panduit/General Cable
 - c. Leviton / Berk-Tek
3. Fiber Cabling Approved Manufacturers
 - a. Same manufacturer from Part 2.
 - b. Corning
4. Non-Cabling / Connectivity Approved Manufacturers:
 - a. Same manufacturer from Part 2.
 - b. Chatsworth

1.8 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. All products shall be in new condition and UL listed.
- B. Only 4-post racks may be used. No wall mounted racks are allowed.
- C. Only flat patch panels may be used. No angled patch panels are allowed.
- D. Provide complete raceway, outlet boxes and miscellaneous items. All conduit utilized shall be EMT grade.
- E. Provide 5" x 2.875" (or 4-11/16" x 3.25" square) deep square outlet box at each outlet location with single gang plaster or tile ring. Provide wall board adapters / accessories as

necessary.

1. Approved solutions:

- a. RANDL 5 Square Telecommunications Outlet Box Model TX-550-YY where “X” could be a bracket box and “YY” could be knockout arrangements.
- b. Hubbell Large Capacity Wall Box Model HBL260. If a 2” knockout is required for installation purposes, provide this box.

F. Communication grounding and bonding shall be constructed and installed to meet or exceed the requirements of the National Electrical Code (NEC), IEC 1000-5-2 and ANSI/J-STD--607-A throughout the entire grounding system.

G. All termination hardware shall be rated to meet specified cabling specifications.

2.2 ENTRANCE FACILITY (EF) / EQUIPMENT ROOM (ER) / TELECOMMUNICATIONS ROOM (TR)

A. General:

1. Contractor shall be responsible for the adequate and appropriate design of all racking systems, paying particular attention to sizing of all cable management troughs and supports both horizontal and vertical installation of patch panels and wire management into rack.
2. Provide line surge suppressors at main telephone board in ER for all incoming phone lines if not provided by service provider. Provide ground connection to TMGB.

B. Provide and install the following, see specifications for each item in this document:

1. Wall Linings in each EF, ER, and TR:

- a. In addition to the architectural walls, provide plywood wall lining that mounts at 8” A.F.F that shall:
 - i. Be fire-rated or treated on all sides with at least two coats of fire-resistant light-colored paint. Fire-retardant plywood is also acceptable. Leave fire rated stamp on plywood unpainted.
 - ii. Have walls lined with A/C grade or better, void-free plywood, 8 feet high with a minimum thickness of ¾”. See plans for additional wall locations.
 - iii. Install the plywood with grade A surface exposed. Plywood shall be securely fastened to wall-framing members to ensure that it can support attached equipment.
 - iv. Use flush hardware and supports to mount plywood.
 - v. Plywood shall be void free and kiln-dried to a maximum moisture content of 15 percent to avoid warping.

2. Main Cross Connect (MC) / Horizontal Cross Connects (HC):

a. Floor Mounted Racks (See Plans for Locations):

- i. Provide four post 19” wide minimum 7’ tall EIA aluminum rack with ANSI/EIA 310-D rail size, 45RU capacity, painted black, top flanges, and mounting holes.
- ii. Provide paint-piercing washers to electrically bond racks.
- iii. Approved Equipment
 1. [Chatsworth 50120-703 Standard Rack](#)
 2. [CommScope RK4P45-45A](#)

3. [Cooper B-Line SB8361908429FB](#)
 4. [Panduit R4P](#)
- b. Copper Patch Panels:
- i. Provide flush mount (flat) high density patch panels of required number and size to accommodate shown telecommunications outlets on plans. (No horizontal cable managers are required). Provide minimum 48 port, 1U, CAT 6 UTP patch panels.
 - ii. Size panels to provide minimum 25% spare capacity. Fill all available space in remaining patch panels so that panels are fully populated.
 - iii. Provide separate patch panel dedicated for video surveillance terminations.
 - iv. Support Category 6 or higher applications.
 - v. Shall accommodate 8-Pin 8-Contact (8P8C) ports.
 - vi. Mount to standard EIA 19" rack.
 - vii. Each patch panel shall include mounted behind it one "towel rack" style cable support bar for each 24 connections that the Contractor shall dress cables using hook and loop type cable ties.
 - viii. Approved Equipment

48-Port Patch Panel Cat 6 (Flat/High Density)		
<u>Manufacturer</u>	<u>Model Name</u>	<u>Flat Patch Panel</u>
CommScope	Uniprise	760105429 M4800 1U Modular Panel, 48 port empty
Siemon	Z-MAX	Z6-P(X)-48 Z-MAX 48-Port, CAT 6 UTP patch panel kit with removable wire manager, 1U, black, with jacks/Z-P(X)-48 Z-MAX 48-Port UTP patch panel with removable wire manager, 1U, black, empty

- c. Fiber Shelves and Cassettes
- i. Provide fiber shelves and cassettes as required to complete project with a maximum of 36 strands in 1RU.
 - ii. Provide rack mounted, sliding type fiber trays as required to complete project.
 - iii. Provide OM3 fiber adapter patch panels that contain modular, dual LC adapter panels as required to complete project. Color for OM3 ports to be aqua.

- iv. Provide minimum 25% spare capacity of fiber adapter panels. Provide additional rack mounted fiber trays/fiber adapter patch panels if necessary to meet 25% spare capacity requirement.
- v. Approved Equipment

<u>Manufacturer</u>	<u>Model Name</u>	<u>Fiber Shelf</u>	<u>Cassette (OM3)</u>
CommScope	LazrSPEED	SD-1U	PNL-CS-12LCX-PT
Panduit	HD-FLEX	FLEX1U06	FHSXO-12-10P
Leviton	Opt-X	<u>5R1UM-S03</u>	SPLCS-12A
Corning	CCH	CCH-01U	CCH-CS12-E4-P00TE

e. Vertical Cable Managers:

f. Vertical Cable Managers:

- i. Provide a vertical cable management panel on both sides of rack.
- ii. Manager shall consist of a metal backbone with cable management fingers that align with EIA rack spacing. Provide cover for all cable management.
- iii. Vertical panel shall be able to manage all the cable on the rack without the aid of horizontal cable managers.
- iv. Size all vertical cable managers according to factory recommendations for the cable being installed. In no case shall design require more than 35% fill ratio when rack is fully populated.
- v. Provide molded plastic slack spools in front to facilitate minimum bend radius compliance.
- vi. Minimum width to be 6".
- vii. Approved Equipment
 1. Chatsworth Velocity Double Sided 1391X-703
 2. CommScope VCM-DS-84-xB (6", 8", 10", 12").
 3. Panduit PatchRunner PRV6
 4. Leviton 8980L-VFR (8")

g. Horizontal Cable Management

- i. Provide horizontal cable management capable of managing copper and fiber cables.
- ii. Manager shall consist of bend radius control throughout the fingers, pass through holes, and transitions between horizontal and vertical pathways.
- iii. Provide front hinged cover that shall open 180 degrees.
- iv. Manager should mount to standard EIA 19" rack.

- v. Size according to factory recommendations for the cable being installed. In no case shall design require more than 40% fill ratio when rack is fully populated.
- vi. Approved Equipment
 - 1. Panduit NMF_X, where X refers to the number of rack units
 - 2. CommScope HTK-19-SS-_{XU}, where X refers to the size.
 - 3. Leviton 492RU-HFR (2RU) or 491UR-HFR (1RU)
 - 4. Chatsworth 13930-70X (X denotes 1-3 RU)
- h. Power Distribution Units (PDUs)
 - i. Provide monitored vertical mount power outlet unit with amperage and voltage indicated on plans. Unit shall have (24) NEMA 5-20R receptacles per circuit and internal thermal breaker of power outlet unit's listed amperage. Provide data cable to each PDU for reporting.
 - ii. Approved Equipment
 - 1. Tripp Lite PDU 2430
- i. Uninterruptible Power Supply (UPS)
 - i. Provide a 3000VA, 120 V rack-mounted UPS in the MDF rack and 1500VA, 120V rack-mounted UPS for each of the other rack/cabinet on project with capability of providing backup to the full connected load for a minimum of 10 minutes, regardless of shown load on electrical panel schedules.
 - ii. Provide a minimum of (2) output receptacles.
 - iii. Provide submittal for each UPS showing run time graph that shows compliance with the specifications.
 - iv. Approved Manufacturers
 - 1. APC
 - 2. Eaton
- j. Cable Tray (only within the EF/ER/TR)
 - i. This cable tray section is only applicable within the EF/ER/TR and does not apply outside of those spaces. See specification 26 0536 Raceway Systems for any cable tray requirements outside of the EF/ER/TR (if applicable to the project.)
 - ii. Provide overhead ladder tray:
 - 1. Tray shall have minimum 6" rung spacing.
 - 2. Size tray according to quantity of cables entering space. However, in no case shall the tray be smaller than 4" high by 6" wide. Do not exceed 50% cable fill of tray.
 - 3. For overhead installations, utilize profile supports to support tray every 5'-0".
 - 4. Provide blind ends to provide closure for a dead-end tray.

5. Provide cable rollers, two at each 90-degree bend. A radius shield or horizontal bend radius may also be used in lieu of cable rollers.
 6. Provide drop-out fittings, or waterfalls, over each cabinet of sufficient quantity to provide an acceptable path for cables to enter equipment. For single cables leaving the tray, utilize a cable drop-out in lieu of a waterfall.
 7. Cables must enter the racks from the top.
 8. Provide conduit to tray adapters for each conduit terminating to cable tray.
- iii. Acceptable Manufacturers
1. [Chatsworth Universal Cable Runway](#)
 2. [Cooper B-Line Redi Rail Runway](#)
 3. [Cablofil PW Ladder Tray](#)
 4. [CommScope Cable Runway](#)
 5. [Panduit WyrGrid Cable Tray](#)
 6. MonoSystems Series MR-16T

2.3 CABLING DISTRIBUTION SYSTEMS AND MISCELLANEOUS EQUIPMENT

A. General:

1. Provide plenum rated cable/connectors if required, cabling/connectors must be appropriate for the environment that it is installed in. Provide wet rated cable for all wet locations, including any conduit in or below slab on grade.
2. Contractor shall be responsible for sizing all pathways such that newly installed cable represents not more than a 35% fill as per manufacturer's directions. Overfilled pathways are the sole responsibility of the Contractor who shall remove and reinstall at Contractors expense.
3. Provide products rated for the environment that it is installed in (i.e. riser, plenum, outdoor). All cabling installed in wet locations (i.e. underground conduit, conduit in slab on grade) shall be listed for use in wet locations.

B. Backbone Cabling Distribution System – Optical Fiber

1. General:

- a. Provide an optical fiber backbone cabling distribution system between telecommunication spaces. Provide OFNR or OFNP as required. Provide 900µm tight-buffered optical fiber cable for premise cable and loose tube for outside plant cable.
- b. Provide fiber jumpers of appropriate length and cable type for each terminated optical fiber port to be connected.

2. Multi-Mode Fiber Optic Cable (OM3)

- a. All multimode optical fiber cabling shall be 50µm/125µm micron laser-optimized cable, designation OM3.
- b. Provide two strands between each EF/ER, ER/TR, and TR/TE for each 48-port patch panel. Provide a minimum of 6-strands of fiber between telecom rooms unless otherwise noted on plans. Provide 25% extra fiber pair strands if more than 6-strands are required. See riser diagram for additional information.

c. Approved Equipment

<u>Manufacturer</u>	<u>Model</u>	<u>Premise Cable (Tight Buffer)</u>	<u>Outside Plant (Loose Tube)</u>
		<u>Plenum</u>	
General Cable	NEXTGEN	<u>BE###1ANU.BK</u>	<u>BExxx4H1A-DWB</u>
CommScope	LazrSPEED 300	<u>P-###-DS-5L-FSUAQ</u>	<u>D-###-LN-5L-F12NS</u>
Berk-Tek	GIGALite	<u>PDPXXX-EB3010/X5</u>	<u>LTPXXX-EB3010/X5</u>
Corning	MIC Cable	<u>XXXT88-31180-29</u>	<u>XXXTSF-T4180D20</u>

3. Connectors:

- a. Provide LC-Duplex Connectors.
- b. Mechanical connectors are acceptable. Do not utilize polish type connectors. Clean all preterm connectors, no exceptions.
- c. For all simplex connectors, provide duplex type clip.
- d. Approved Manufacturers:

<u>Manufacturer</u>	<u>Multi-Mode (OM3)</u>
CommScope	<u>MDC-LCR-16-BG</u>
Panduit	<u>FLCDMx</u>
Leviton	<u>49990-LDL</u>
Corning	<u>95-051-98-SP-X</u>

C. Backbone Cabling Distribution System – Copper

1. General:

- a. Provide copper backbone distribution system between telecommunication spaces as shown on drawings.

2. Backbone Cabling Distribution System

- a. Provide multiple pair Cat 6 cable with wire count as shown on drawings.
- b. Acceptable Manufacturers:
 - i. Copper backbone cabling shall be by same manufacturer as copper horizontal cabling.

3. Copper Termination:

- a. Voice and data as required for all building telecommunications needs must be terminated on its own patch panel on the rack.
- b. Systems can mount on the same rack but each system must be terminated on its own patch panel such as WAP, Cameras, and Data.

3. Multipair Bundle Copper Termination Blocks:

- c. Provide termination blocks that support Category 6 applications and facilitate cross-connection using either cross- connect wire or patch cords.
- d. Provide termination blocks for voice and data as required for all building telecommunications needs. A minimum of two Category 6 termination blocks shall be provided at each back board location sized for incoming telecommunications needs.

- e. Connecting hardware block shall support all Category 3, 5e or 6 applications and facilitate cross-connection and/or inter-connection using either cross-connect wire or patch cords.
 - f. Provide wiring spindles and channels as necessary to allow neat bundling of all wire and cable. Provide wiring channel (horizontal) above and/or below each termination block. Provide wiring channels by same manufacturer of termination block. Provide Velcro type ties for all cables at telephone backboard not run in conduit or channels. Provide wiring channel from demarcation point to termination block.
 - g. Approved Equipment
 - i. Panduit GPKBW24Y Punchdown Kit.
 - ii. Leviton CAT6+ 110-style wiring block (96-pair) # 41AB6-1F4
 - iii. Commscope
4. Primary Protection (Surge Protection)
- a. General
 - i. Provide and surge protection for each pair of copper cabling between buildings and any end point devices that are located outside. For example, if a camera is mounted or located on the exterior of the building—surge protection is required.
 - ii. Surge suppressions shall be achieved through 5-pin, solid state, plug-in type modules for each conductor pair.
 - iii. Provide necessary grounding of equipment to building electrical ground. Size all grounding conductor based on distance to electrical ground according to the requirements of this section.
 - iv. Provide 25% spare modules.
 - v. Approved Equipment
 - 1. For data outlets where POE is present
 - a. ITWLinx 1Gb CAT6-POE.
 - 2. For outlets where no POE is present
 - a. ITWLinx 1Gb CAT6-LAN
 - 3. For copper multi-pair backbones
 - a. ITWLinx ML25-CAT5-75
 - 4. If power is required on all four pairs. (Note: If Cisco switches are connected via a copper backbone, this product is required.)
 - a. ITWLinx 1Gb CAT6-75
- D. Horizontal Cabling Distribution System – Balanced Twisted Pair
- 1. General:
 - a. Provide and install appropriate number of Category 6 horizontal cables, patch cables, work area cables, for all terminated data drops, between switches, etc. so that building-wide networking will be operational once all installation is complete.
 - 2. Horizontal Cabling

- a. Provide Cat 6 UTP, min-compliant, 4-Pair 100Ω Balanced Twisted Pair Cable to all locations shown on plans.
- b. Provide cabling rated for the environment that it is installed in (i.e underground conduit, conduit in slab on grade). All cabling installed in wet locations shall be listed for use in wet locations.
- c. Provide a minimum of (2) cables, unless otherwise noted, to each location shown on plans.
 - i. Provide (2) Category 6 cables to each wireless access point (WAP).
 - ii. Clearly label all locations of wireless access point (WAP) on ceiling grid with “flag label” with black text and white label for WAP connection.
- d. Provide Horizontal cabling in the following color scheme:
 - i. Data, Access Control, Intrusion, Server – Blue
 - ii. Wireless Access Points – Yellow
 - iii. Cameras – Orange
 - iv. Intercom - Green
- e. Approved Equipment

<u>Cat 6</u>			
<u>Manufacturer</u>	<u>Model</u>	<u>Riser</u>	<u>Plenum</u>
General Cable	GenSPEED 6	<u>7133800</u>	<u>7131800</u>
CommScope	Uniprise	65N4	<u>6504</u>
Berk-Tek	LANmark-6	<u>10136339</u> (Blue, CMR)	<u>10136226</u> (Blue, CMP)

- f. Field Terminable Plug (FTP)
 - i. Provide an FTP for each camera and WAP. Provide one FTP for each camera and two FTPs for each WAP. Confirm FTPs are compatible with WAPs and Cameras. Provide one FTP for each device shown in the ceiling.
- g. Approved Equipment

<u>WAP/Camera Field Terminable Plug</u>	
<u>Manufacturer</u>	<u>Model</u>
Panduit	FP6X88MTG
Leviton	6APLG-S6A

- 3. Patch and Work Area Cables:
 - a. Patch cables to be provided by owner.

- i. Contractor shall assist owner with patch cords and work area cable quantities.
 - b. No patch or work area cords shall in any case exceed in total 10 meters as per TIA Standard unless design includes Standards compliant MUTOA (multi-user termination outlet) and work area cord adjustments are made according to recommendations for zone cabling contained within TIA 568-C or most recent revision at the time of installation. Coordinate with owner for preferred patch cord lengths at patch panel and work area.
 - c. Copper patch cord and work area outlet cabling must be provided by the same manufacturer and meet the same performance standards as the horizontal cabling.
 - d. Patch cord and work area cables shall be blue.
 - e. Provide (1) 5 foot, 2-strand optical fiber patch cable for each patch panel, utilizing same performance standards and connector types as specified for the backbone. The cable shall be provided by the same manufacturer and meets the same performance standards as the backbone optical fiber.
4. Telecommunications Outlets/Connectors (See Plans for Locations):
- a. Flat Faceplates:
 - i. Provide modular type information outlets with flat telephone jack or data outlet. Provide single gang faceplate kits to allow up to six data or voice jacks as shown on plans. Provide faceplate kits for wall outlets in colors and materials that match power wiring device plates. Provide faceplate kits that allow labeling schemes described herein. Faceplates shall accept STP, UTP, fiber optic or audio/video modules as an option.
 - ii. Blank off all unused ports.
 - iii. Color: Standard color as selected by owner/architect.
 - b. Connector:
 - i. Color: Standard color as selected by owner/architect.
 - c. Approved equipment

<u>Manufacturer</u>	<u>Model</u>	<u>Connector Cat 6</u>
CommScope	GigaSPEED XL	MGS400-xxx
Panduit	NetKey	NK688Mxx
Leviton	QuickPort, eXtreme	6110-Rx6

<u>Manufacturer</u>	<u>Model</u>	<u>Plastic Faceplates</u>
CommScope	GigaSPEED XL	M14AS-xxx
Panduit	MiniCom TX6 Plus	CFPSLxxxY
Leviton	QuickPort, eXtreme	41081-xxP

PART 3 – EXECUTION

3.1 GENERAL

- A. Prior to pathway rough-in, low voltage contractor shall meet with electrical contractor to review pathway installation requirements.
- B. Pathway Requirements:
 - 1. General:
 - a. All pathways shall be designed, constructed, grounded and installed in accordance with all recommendations delineated within TIA 569-B and Standard TIA 942.
 - b. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. Arrangements to remove any major obstructions not identified on plans need to be determined at that time with the Engineer.
 - c. Paint all electrical boxes and their covers for the telephone and data system green (Kwal Paint Java Green AC098N).
 - 2. Cable Tray Within EF/ER/TR:
 - a. Wrapped around room (wall support is acceptable)
 - b. Along equipment rows leading to cross-connects.
 - c. Ground tray to TGB or TMGB (whichever is closer) utilizing #6CU bare wire.
 - d. Coordinate tray locations with lighting, air-handling systems, and fire extinguishing systems so that fully loaded trays will not obstruct or impede their operation.
 - i. Install cable tray under mechanical components for access for future cabling needs; coordinate the mounting height of the cable tray with Owner IT Representative prior to installation. Do not install cable tray at the top of a ceiling which is inaccessible due to the excessive height.
 - 3. Racks / Cabinets:
 - a. Racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by local codes.
 - b. Racks shall be placed with a 36-inch (minimum) clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.
 - 4. Conduits:
 - a. For any interior/exterior conduit 4" and larger, provide (3) 1.25" plenum-rated corrugated innerducts.
 - b. Flexible conduit is not acceptable as cable tends to creep, shift, or have sheath damage.

- c. Achieve the best direct route parallel with building lines with no single bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.
 - d. Conduit runs shall not have continuous sections longer than 100 feet without a pull box and may only be filled to 35% capacity.
 - e. Ream all conduit ends and fit with an insulated throat nylon bushing with non-indenter type malleable steel fittings to eliminate sharp edges.
 - f. Telecommunications conduits should not be routed over or adjacent to heat sources such as boilers, hot water lines, or steam lines. Neither should they be routed near large motors, generators, photocopy equipment, or electrical power cabling and transformers.
 - g. Conduits that enter an EF/ER/TR must terminate near the corners to allow for proper cable racking. Terminate these conduits as close as possible to the wall where the backboard is mounted to minimize the cable route.
 - h. Terminate conduits that protrude through the structural floor 1" to 3" above the surface within an EF/ER/TR.
 - i. After installation, conduits shall be clean, dry, unobstructed, capped for protection, labeled for identification, reamed and fitted with bushings.
 - j. A 200lb pull cord (nylon, 1/8" minimum) shall be installed in any empty conduit.
 - k. When the number of conduits requires more than one row, restrict the number of rows to two wherever practicable.
5. Open Top Cable Support Requirements:
- a. Provide wide surface area open-top cable supports spaced 5 feet apart at the maximum to adequately support and distribute cable's weight. Follow manufacturer specifications for cable loading. Provide supports that have a galvanized finish with wide base specifically for telecommunications cabling.
 - b. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables
 - c. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
 - d. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports.
 - e. Approved Equipment
 - i. Erico Caddy-Cat HP
6. Pull Box Requirements:
- a. NEC sized pull boxes are not acceptable. Follow BICSI and EIA/TIA 569-B guidelines for pull box sizing.
 - b. Provide pull boxes in sections of conduit that are 100 feet or longer, contain more than two 90-degree bends, or contain a reverse bend.
 - c. Conduits that enter the pull box from opposite ends should be aligned.

- d. Pull boxes shall have a length 12 times the diameter of the largest conduit.
 - e. All pull boxes must be accessible.
- C. Cabling System:
- 1. Follow T568B scheme for copper cabling terminations.
 - 2. Life Safety Related Cabling:
 - a. Provide the specified category cabling in 1" conduit from elevators and or lifts. Cabling shall terminate at telephone service demarcation point. .
 - b. Provide the specified category cabling in 1" conduit for two phone lines to the fire alarm control panel back to telephone service demarcation point.
 - c. Provide the specified category cabling in 1" conduit for the two-way communication system Main Control Panel back to telephone service demarcation point.
 - 3. Miscellaneous Related Cabling:
 - a. Provide the specified category cabling in 1" conduit for two data connections to Intrusion Detection System head-end back to EF or demarcation room. Refer plans for exact locations..
 - b. Provide the specified category cabling in 1" conduit for two data connections to Access Controls System head-end back to closest data rack. Refer to plans for exact locations.
 - c. Provide the specified category cabling in 1" conduit for one data connection to Intercom head-end back to closest data rack. Refer to plans for exact locations. Provide specified category cabling and conduit between intercom head-end and access control panel.
 - d. Provide the specified category cabling in 1" conduit for Main Building Management System (ATC Panels, etc) back to nearest ER/TR room. Refer to Mechanical plans for exact location.
 - e. Provide the specified category cabling in 1" conduit for Advanced Energy & Power Metering System back to Main Building Management System Panel. Refer to plans for main switchboard location.
 - 4. Backbone cables shall be installed separately from horizontal distribution cables. Provide plenum rated innerduct if required, innerduct must be appropriate for the environment that it is installed in.
 - 5. It is acceptable to install innerduct within cable tray as long as the fill ratio is not exceeded.
 - 6. Fiber slack shall be neatly coiled within the fiber enclosure or cable tray. No slack loops shall be allowed external to the fiber panel. Each cable shall be individually attached to the respective fiber enclosure by mechanical means.
 - 7. Provide a minimum of one balanced twisted pair cable to each voice outlet and one balanced twisted pair cable to each data outlet shown on the drawings unless noted otherwise on the drawings.
 - 8. Provide a minimum 6" service loop in each communications system junction box for balanced twisted pair. Cables shall be coiled in the in-wall boxes if adequate space is present to house the cable coil without exceeding manufacturers bend radius.
 - 9. Provide a minimum 10' service loop in each EF/ER/TR/TE.

10. Provide a minimum 2' service loop at each stub-up or at each transition from conduit to cable tray.
11. Provide a 5' service loop in the ceiling before the conduit travels down the wall and terminates into the communications junction box.
12. Provide a 25' loop at all wireless access point (WAP) locations above the ceiling.
13. Provide modular jacks for each installed cable at outlets shown on drawings. Blank off all unused ports on faceplate.
14. Provide Velcro type ties for all cables and install in a neat and workmanlike manner. Where applicable, use plenum rated Velcro. Where cable is installed in cable tray, bundle a maximum of 25 cables in each Velcro tie. No zip ties are permitted whatsoever.
15. The bending radius and pulling strength requirements of all backbone and horizontal cables shall be observed during handling and after installation. Use pulling compound as recommended by manufacturer.
16. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft) from the telecommunications outlets in the work area to the horizontal cross connect.
17. The combined length of all patch cords in the EF/ER/TR and the work area shall not exceed 10m (33 ft)
18. No splices are allowed.
19. In a false ceiling environment, a minimum of 3 inches shall be observed between cable supports and false ceiling. At no point shall cable(s) rest on acoustic ceiling grids or panels.
20. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
21. Cables shall not be attached to ceiling grid seismic support wires or lighting fixture seismic support wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.
22. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
23. Pulling tension for balanced twisted pair shall not exceed 25lbf and for optical fiber shall not exceed 50lbf.
24. Pair untwist at the termination shall not exceed 0.125". The cable jacket shall be maintained as close as possible to the termination point.
25. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
26. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.
27. Clearly label all locations of wireless access point (WAP) on ceiling grid with "flag label" with black text and white label for WAP connection.
28. Copper Backbone Terminations:
 - a. Terminate one single pair on pins 4, 5 at each patch panel port. Terminate all pairs on patch panel located on rack.

D. Grounding System:

1. All grounding and bonding shall be done according to ANSI J-STD-607-A, TIA 942, and NEC.
2. All cabinets/racks shall utilize paint piercing grounding washers, to be used where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack.
3. All racks shall further utilize a full-length rack ground strip attached to the rear of the side rail with the thread-forming screws provided to ensure metal-to-metal contact. Similar to Panduit RGS.
4. All active equipment from owner shall be bonded to ground. If the equipment manufacturer provides a location for mounting a grounding connection, that connection shall be utilized. All active equipment shall be bonded using the appropriate jumper for the equipment being installed using the thread-forming screws. Similar to Panduit RG.
5. Racks shall have individual, appropriately sized conductors bonded to the grounding backbone. Do not bond racks or cabinets serially – daisy-chained rack grounds will not be accepted.
6. Patch panels shall be bonded to racks using the appropriate bonding screws. Mounting rails may utilize cage nuts, threaded holes or thru hole mounting fasteners to secure patch panels to the rails.
7. Bond cable tray, raceway system, structural steel and all other metal equipment located within EF/ER/TR to the grounding bus bar utilizing copper conductors per the following schedule:
 - a. $\leq 25'$ - #34
 - b. $\leq 50'$ - #2
 - c. $\leq 66'$ - #2/0
 - d. $\geq 67'$ - #3/0
8. Provide 4" X 12" X 1/4" CU Telecommunication Main Grounding Bus Bar (TMGB) with bonding conductor per schedule above to Intersystem Bonding Terminal (IBT) in each telecommunication room (EF/ER/TR) with a main cross-connect (MC). Provide 20% spare termination spaces on bus bar, provide additional bus bars as necessary to accommodate spare.
9. Provide 2" X 12" X 1/4" CU Telecommunication Grounding Bus Bar (TGB) with bonding conductor per schedule above to TMGB in each room with a horizontal cross-connect (HC).
10. Refer to electrical diagrams for additional ground connection requirements.

E. Electromagnetic Compatibility:

1. General:
 - a. Do not install power feeders above or within the telecommunications room. Do not install telecommunications conduits above electrical panelboards, switchboards, transformers, motor control centers, etc.
 - b. Where telecommunication cable is installed in grounded, metallic conduit near power cables, the power cables shall be kept physically separated from telecommunications cables:
 - i. Circuits Under 5kVA: 2" minimum separation.
 - ii. Circuits Over 5kVA: 6" minimum separation.

- iii. Electrical motors/transformers: 48" minimum separation.
 - iv. Lighting ballasts: 6" minimum separation.
 - c. Where telecommunication cable is installed in cable tray or underground in non-metallic conduit near power cables, the power cables shall be kept physically separated from telecommunications cables by a minimum of 12"
- F. EF/ER/TR Power Requirements:
- 1. General: Regardless of what is shown on drawings, the minimum requirements for providing power in the EF/ER/TR are as follows and shall be included in bid:
 - a. Two dedicated, nonswitched 120V/20A duplex receptacles, each on individual branch circuits.
 - b. 120V/20A Duplex receptacles located +6" A.F.F. placed at 6 foot intervals around perimeter walls. Up to 10 receptacles may be placed on a single circuit.
- G. Firestopping and Smoke/Acoustical Pathways(See Also Division 7):
- 1. Provide firestop/smoke barrier solution equivalent to the wall/ceiling/floor rating.
 - 2. Provide firestop labels next to each penetration with written date. Label both sides of the penetration.
 - 3. Firestop systems shall be UL Classified to ASTM E8124 (UL 1479). A drawing showing the proposed firestop system shall be provided to the Engineer prior to installing the Firestop system(s).
 - 4. Utilize firestop pass-through type devices for medium to large penetrations into fire walls/floors.
 - 5. Provide a minimum of (4) 4" trade size Hilti Speedsleeves (or STI EZPath) with at least one spare for each and every firewall penetration where cable tray meets the wall.
 - 6. Provide the following products:
 - a. Fire Rated; STI EZ-Path Fire-Rated Pathways Series (or Hilti Speed Sleeve CP 653 BA)
 - b. Smoke/Acoustical Rated; STI EZ-Path Smoke & Acoustical Pathway Series (or Hilti Smoke and Acoustic Sleeve CS-SL SA)
- H. Miscellaneous Equipment:
- 1. Arrange all terminal blocks in a manner that allows natural wiring progression and minimizes crossing of wires.
 - 2. Provide patch cords and cross connect cables as necessary for a complete operational telephone and data network system. Consult with owner to determine any special needs such as dedicated phone lines.

PART 4 – LABELING

4.1 GENERAL

- A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and

patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

- B. All telecommunications spaces, pathways, cables, connecting hardware, equipment, racks, patch panels, outlet/connectors, and grounding system shall be labeled in accordance with TIA/EIA 606-A.
- C. All labels shall meet UL 969 requirements for legibility, defacement and adhesion requirements. Handwritten, Ink, or Laser Printing labels are not allowed. Provide labels using thermal transfer print. Heat shrinking or wraparound labels are required, flag style labels are not allowed.

4.2 TELECOMMUNICATION PATHWAYS

- A. Identify each dedicated pathway (including inner ducts) for the voice and data system.
- B. Label pathways at regular intervals and wherever they are accessible.

4.3 TELECOMMUNICATION CABLES

- A. Identify cables at each end with a permanent label or physical/electronic tag.
 - 1. The same alphanumeric identifiers should be used at both ends of the cable.
 - 2. Identify cables at regular intervals throughout and wherever they are accessible.
 - 3. Cables shall be identified in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate that can be accessed by removing the cover plate and to the cable behind the patch panel on a section of cable that can be viewed without removing the bundle support ties. Cables labeled within the bundle where the label is obscured from view shall not be acceptable.

4.4 CONNECTING HARDWARE

- A. Identify connecting hardware items (termination blocks, cross-connects, racks, cabinets, patch panels, telecommunications outlet/connectors, ports) using alphanumeric identification such as the following three-level scheme:
 - 1. First level—Termination field or patch panel. Color-coding or other labeling should be used to uniquely identify each termination field (e.g., voice and data) on a common mechanical assembly.
 - 2. Second level—Terminal block within a given field or patch panel that could be a row of insulation displacement connectors (IDCs), optical fiber connectors, or modular jacks.
 - 3. Third level—Defines the individual position within a given terminal block or patch panel.

4.5 TELECOMMUNICATIONS GROUNDING SYSTEM

- A. Identify each telecommunications grounding bus bar (TGB) and telecommunications main grounding bus bar (TMGB).
- B. Identify each grounding conductor relating to the telecommunications system, including those connecting building steel, grounding electrodes, water pipes, and telecommunications structural components.

PART 5 - MISCELLANEOUS

5.1 TESTING:

A. General

1. Provide testing within 10 days of completion for all copper and fiber optic cable according to TIA/EIA standards and any other requirements of the manufacturer who will provide warranty.
2. Submit copy of current calibration of all testing equipment. Submit all test reports electronically to architect/engineer and include in O&M manuals to include test reports. Meter shall have been calibrated within the past 12 months.
3. Correct any malfunctions. Contractor shall re-terminate/replace any cable, connection, or equipment found to be defective or non-compliant with these specifications and referenced standards.
4. Invite Owner IT representative and Engineer to witness and/or review field testing. Notify five business days prior to commencing testing.

B. Copper Cable

1. Utilize Level IIIe Tester to test all equipment and each outlet, horizontal cable, termination block, patch cords, etc. to verify compliance with requirements. Testing shall consist of industry accepted verification tests for the Category of cable installed and shall meet latest requirements of EIA/TIA cabling Standards.
2. UTP Cable and Links: All UTP cabling channel must be tested at swept frequencies up to 250MHz for internal channel performance parameters as defined in IEEE 802.3an and ANSI/TIA/EIA-568C. Certifications shall include the following parameters for each pair of each cable installed:
 - a. Wire map (pin to pin connectivity)
 - b. Length
 - c. Insertion Loss
 - d. Near End Crosstalk (NEXT)
 - e. Attenuation to Crosstalk Ratio Far End (ACRF)
 - f. Return Loss
 - g. Propagation Delay
 - h. Delay Skew
 - i. DC Loop Resistance
 - j. DC Resistance Unbalance
 - k. Power Sum Near-End Crosstalk (PS-NEXT)
 - l. Attenuation to Crosstalk Ratio Near-End (ACR-N)
 - m. Power Sum Attenuation to Crosstalk Ratio Near-End (PS-ACR-N)
 - n. Attenuation to Crosstalk Ratio Far-End (ACR-F)
 - o. Power Sum Attenuation to Crosstalk Ratio Far-End (PS-ACR-F)
 - p. Transverse Conversion Loss (TCL)
 - q. Equal Level Transverse Conversion Transfer Loss (ELTCTL)

3. All channels that fail testing parameters will be replaced at the Contractor's expense until all channels pass the performance parameters.
 4. Provide Modular Plug Terminated Link (MPTL) test for all field terminated plugs (standard for cameras and WAPs).
 - a. All installed cabling modular plug terminated links (MPTL) shall comply with the permanent link transmission requirements of the ANSI/TIA-568-2.D standard.
 - b. The MPTL shall be tested with a Permanent Link Adapter on the Main Unit and a Patch Cord Adapter Suitable for Category 6A testing on the Far End or Remote Test Equipment.
 - c. Modular plug terminated link test results, including the individual frequency measurements from the tester, shall be recorded in the test instrument upon completion of each test for subsequent uploading for reports to be generated.
 5. Sampling is not acceptable. MPTL testing shall be performed on each cabling segment (connector to connector).
- C. Fiber Optic Cable
1. Provide test results using an OTDR of all installed fiber optic links to demonstrate compliance with requirements. Testing shall consist of industry accepted verification tests for the type of cable installed and shall meet the latest requirements of EIA/TIA 455-53A standards. Test setup and performance shall be conducted in accordance with ANSI/TIA/EIA 526-14 Standard Method B.
 2. Provide inspection of fiber end faces by using scope and test according to IEC 61300-3-35 standards. Correct scratched, pitted, or dirty connectors.
 3. Provide bi-directional testing of cable for both cable rated wavelengths. Results shall show compliance of cable and shall include the following parameters:
 - a. Attenuation
 - b. Length
 - c. Verification of Polarity
- D. Owner reserves the right to hire an independent testing company to spot check the test results. If the results vary more than 10% from the results provided by the Contractor, the Contractor will be required to prove his results are correct or retest the entire system.
- 5.2 WARRANTY:
- A. Register installation with cable/connectivity manufacturer.
 - B. Provide and submit all test results to owner, engineer, and manufacturer and meet all other manufacturer requirements in order to provide minimum 20-year extended product link warranty for complete cabling/connectivity installation, including all copper and optical fiber utilized on the entire channel. The channel warranty shall be provided by the connectivity manufacturer. Include replacement material and installation for any defective product.
- 5.3 OPERATING AND MAINTENANCE MANUALS: Refer to Section 26 0502 for requirements.
- 5.4 TRAINING:
- A. Provide four hours training on the operation and installation of the structured cabling system at job site, at no cost to owner.

5.5 RECORD DRAWINGS: Refer to Section 26 0502 for requirements.

END OF SECTION 27 1500

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SECTION 27 4100 - AUDIOVISUAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26, 27 & 28 basic materials and methods sections apply to work specified in this section.
- C. Refer to specification 26 0553 for conduit and junction box color requirements.
- D. All unshielded category 'UTP' and/or optical fiber cable, for AV equipment, used on this project shall match the horizontal cabling within the building.
 - 1. Category cables used for transporting video, audio and controls simultaneously from transmitters to receivers and/or switchers shall follow the Manufacturer's recommended cabling specifications.

1.2 ADMINISTRATIVE REQUIREMENTS:

- A. BNA Project Contact:
 - 1. Eric Mangum, CTS-D
 - a. Phone: 801-532-2196
 - b. Email: emangum@bnaconsulting.com
 - 2. Jaime Verhaal, CTS-D
 - a. Phone: 801-532-2196
 - b. Email: jverhaal@bnaconsulting.com
- B. Bid Submittal:
 - 1. Equipment Costs: Breakout cost of material and labor as different line items.
- C. Coordination:
 - 1. Coordinate final inspection of the systems installed, with Audiovisual (AV) Consultant, three (3) weeks in advance.
 - 2. Obtain GANTT chart for construction time frame from the General Contractor.
 - 3. Coordinate with Electrical contractor to meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate the mounting condition of all ceiling-mounted AV equipment with ceiling type. During second meeting, coordinate the location of all ceiling-mounted AV equipment in each area.
 - 4. Meet at least once with the mechanical installer prior to fabrication and installation of duct work. Coordinate depth and location of all loudspeaker and duct work in all areas.
 - 5. Meet with Electrical contractor prior to pathway rough-in to coordinate AV system requirements in each area.
 - 6. Meet at least once, prior to rough-in, with horizontal cabling installer to verify all AV network requirements. Coordinate cable color according to specification 26 0553.
 - 7. Meet at least twice with owner and programmer to coordinate AV network requirements. Hold the first meeting after submittal of shop drawings to coordinate network protocols, including but not limited to: IP address schedules, MAC address

schedules, patchbay schedules, security requirements, and VLANs. Hold the second meeting prior to AV system deployment.

8. Coordinate color and finish of all AV system components with Architect or Electrical contractor as appropriate.
 9. Coordinate all AV system components within millwork/furniture with millwork shop drawings prior to rough-in.
 10. Notify AV Consultant when rough-in is complete and ready to inspect. AV Consultant and Electrical Engineer to sign off on rough-in prior to rough-in resuming rough-in for typical rooms.
- D. Contractor is responsible for coordinating with all other trades for equipment locations, mounting requirements, supports and plenum space requirements.

1.3 DESCRIPTION OF WORK:

- A. Provide the specified systems in a complete and operating condition with all necessary materials and labor to fulfill the requirements and the intent of the drawings and specifications. Except as otherwise indicated, provide manufacturer's standard system components. Contractor shall furnish all cables, materials and equipment, whether specifically mentioned herein or not, to ensure a complete and functional system.
- B. Master quotes do not relieve contractor from performing due diligence for equipment type, equipment quantity, and quantity of room types. Any errors, conflicts, or omissions between the drawings and/or specifications and master quotes shall be the responsibility of the contractor to resolve.
- C. Bidders wishing to provide equipment other than the equipment specified shall submit proposed substitute equipment to AV Consultant eight (8) working days prior to bidding. Submittals for prior approval shall include description of equipment, design intent, complete riser diagrams for proposed equipment, equipment specifications, cut sheets of proposed equipment, reason for alternate equipment. AV Consultant may request physical equipment to test and demo. Acceptance of proposed equipment by AV Consultant shall not relieve AV contractor from responsibility to provide audio-visual systems equal to those specified in this Section. Contractor shall be ultimately responsible for providing complete and working audio-visual systems that function, control and operate in the same manner as the specified equipment. AV Consultant has final say if proposed equipment is equal to the specified equipment. Equipment that AV Consultant is not familiar with will require the contractor to provide manufacturer training at manufacturer's facility and have a manufacturer representative present at time of commissioning.
- D. Refer to section 2.2 for approved equals of basis of design equipment.
- E. Equipment submitted in the bid proposal that has not been approved by AV Consultant in writing will not be accepted and shall be replaced by approved equipment at contractor's expense. Equipment not listed within this specification, or contract documents, that is required for a complete and working system, shall be of professional grade, new and used in the same manner as needed for a complete and working system.
- F. Input plates shall match the color and style being used throughout the project.
- G. All control processors and controllers are to be on an unswitched power connection and connected to an uninterrupted power supply if indicated within the design.

1.4 DEFINITION OF TERMS:

- A. Approve: The term "approved," where used in conjunction with the Engineer's action on the Contractor's applications and requests, is limited to the Engineer's duties and responsibilities as stated in General and Supplementary Conditions.

- B. Configure: The term "Configures" or "Configuration" is used to describe set up of components which includes menu based settings, image alignment, dip switches, setup wizards, EDID, etc. required for standard functionality.
- C. Contractor: the term "Contractor" refers to the company contracted to perform the work within this specification and associated documents.
- D. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.
- E. Furnish, Install, and Provide: Refer to 26 0500 for definition.
- F. General: Basic Contract definitions are included in the General Conditions.
- G. Graphical User Interface (GUI): The term "Graphical User Interface (GUI)" is used to describe the user interface from a touch screen. This is a custom interface provided with the programming of the system.
- H. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.
- I. Installer: An "Installer" is the Contractor, or an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor, for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
- J. Programming: The term "Programming" is used to describe writing computer code or a sequence of logic to perform an operation from a triggering event. Programming will be installed on a control processor or similar platform identified within the documents.
- K. Programmer: the term "Programmer" is the company or entity engaged by the programming company, either as an employee, subcontractor, or sub-subcontractor, for providing the programming services.
- L. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- M. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions."

1.5 QUALITY ASSURANCE:

- A. Installer:
 - 1. Integrating firm shall have worked satisfactorily for a minimum of five (5) years of completing systems equal to this scope, quality, type and complexity.
 - 2. Key personnel assigned to the project shall each have minimum of ten (10) years of experience in completing systems equal to this scope, quality, type and complexity.
 - 3. Contractor shall be a factory authorized distributor of all equipment specified for the geographical area of the project.
 - 4. Contractor shall maintain complete installation and service facilities for the duration of the project contract.

5. Contractor shall have current manufacturer certificates for all AV systems and equipment listed within this specification.
 6. Contractor shall be in good standing with the owner.
 7. Contractors that do not meet the above requirements cannot bid on this project.
- B. Contractor must follow the standards described within:
1. BICSI/AVIXA AV Design Reference manual.
 2. ANSI/AVIXA 2M-2010 Standard guide for Audiovisual Systems Design and Coordination Processes.
 3. ANSI/AVIXA 10:2013 Audiovisual Systems Performance Verification Guide.
- C. All work shall be done by expert technicians qualified in the field with knowledge of specified systems. Workmanship shall comply with industry best practices concerning grounding, shielding, cable dressing, cable termination and equipment mounting.
- D. PRE-APPROVED INSTALLERS:
1. AVI-SPL
 2. Cache Valley Electric
 3. Ford AV
 4. GenComm
 5. LINX lectric
 6. Marshall Industries
 7. Performance Audio
 8. Poll Sound
 9. Wasatch Electric
 10. WEBB AV
 11. Bids submitted by non-approved installers will not be accepted.
 12. Bidders not pre-approved shall submit in writing the following for review at least eight (8) working days prior to bid:
 - a. List of qualifications including:
 - i. Industries certifications including manufacturers.
 - ii. Approved resale manufacturers.
 - b. Past and current projects within the last five (5) years similar in scope and size.
 - c. Three (3) Different referrals from the owners of three (3) different projects within the last five (5) years.
- 1.6 SUBMITTALS: Refer to specification 26 0502 for shop drawing submittal requirements.
- 1.7 WARRANTY:
- A. Systems shall be guaranteed for a period of one (1) year from the date of substantial completion against defective materials, inferior workmanship or improper installation adjustment. Guarantee shall cover all parts and labor, etc. required to maintain the functionality at the time of system completion.
1. System completion shall be signed off by the programmer, contractor, and the owner. At that time the system will be considered complete.
- B. If system failure causes the audiovisual system to be inoperative or unusable for its

intended purpose, contractor, when notified of the problem, shall repair the system to be operational and usable within three (3) business days. If defective components cannot be repaired in time, provide temporary equipment as required.

- C. The contractor shall utilize their existing service department for warranty calls. Trouble shooting of system components shall be performed before adjustment to the programming is required.
- D. Contractor shall honor equipment warranties for term established by manufacturer if greater than warranty time frame mentioned above.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. All equipment shall be installed as shown on the drawings and in strict accordance with the specifications. Any errors, conflicts, or omissions discovered in the specifications or the drawings shall be submitted in writing to the AV Consultant for clarification.
- B. Equipment lists are provided to identify quality and functional expectations. They may not be complete. Coordinate with devices shown on drawings, system risers and equipment lists for system intent. Provide a complete and functional system as described within the construction documents.

2.2 MANUFACTURER APPROVED EQUALS:

- A. The Manufacturers listed below have the potential to be considered equals, as it relates to the system design intent and the equipment specified herein. Refer to section 1.3.C. for substitution requirements. Any equipment chosen as equal to what has been specified in section 2.4 will be the responsibilities of the AV Integrator to coordinate all resulting changes and guarantee a complete and functional system e.g. rough-in requirements, programming, etc. Please note that some components have been chosen over others for features and/or size limitations. Equipment listed below with an asterisk have feature and/or size limitations and may not be substituted.
 - 1. Amplifiers – Ashly, Crestron, Crown, Extron, Lab Gruppen, LEA Professional, Powersoft, and QSC
 - 2. Assisted Listening Systems – Listen Technologies, Williams AV
 - 3. Cables – Belden, Crestron, Extron, Gepco/General, Ice, Kramer, Liberty, and Westpenn cables
 - 4. Controls – Crestron, Extron and QSC
 - 5. Displays – LG, NEC, Planar, Panasonic, Samsung, Sharp, and Sony
 - 6. DSPs – Biamp, Extron, QSC and Symetrix
 - 7. Equipment racks – AtlasIED, Chief, Lowell and Middle Atlantic
 - 8. Loudspeakers – AtlasIED, Bose, Community, JBL and QSC
 - 9. Microphones – AKG, Audio Technica, Audix, Lectrosonics, Sennheiser and Shure
 - 10. Mounts – Chief and Premier mounts
 - 11. Network equipment – Cisco, Luxell, and Netgear
 - 12. Networked Audio – Attero tech (QSC), Extron, and RDL
 - 13. Projection Screens – Da-Lite, Draper and Stewart Filmscreen
 - 14. Video Equipment – AMX, Crestron, and Extron
 - 15. Wall plates – Attero tech (QSC), Crestron, Extron, RCI Custom, Liberty Panelcrafters and RDL

2.3 GENERAL EQUIPMENT REQUIREMENTS:

- A. The equipment specified in this document aims to fulfill the intended functional requirements by precisely identifying the necessary equipment. Depending on the timing of component orders and the project timeline, there may be instances where certain equipment needs to be replaced with newer models. In the event that the indicated equipment is unavailable or has been replaced, the supplier or contractor shall provide a new model that offers comparable functionality.
- B. Loudspeakers:
1. Provide applicable mounting equipment as needed, including but not limited to; back boxes, mounting hardware, safety equipment, and seismic restraints.
- C. Video Signal:
1. The equipment listed below is considered to be equal replacement parts for a point-to-point video solution as it relates to the system design intent. Equipment listed in section 2.4 override the equipment listed below.
 - a. Cable Equalizer for cable lengths exceeding 30' but no more than 75' or that have more than two (2) union connections. Connect to external power supply and do not use the 5 volts within the HDMI cable.
 - i. Extron – HD 4K 101 Plus or Kramer – PT-3H2
 - b. Point to point HDBaseT extension, 18 Gbps, 4k60 4:4:4 at 100 Meters:
 - i. Crestron – DM-TX-4KZ-100-C-1G with DM-RMC-4KZ-100-C. or Extron – DTP2 T 211 with DTP2 R 211.
 - c. HDMI cables intended for client device connection and that are less than 15' shall be a flexible cable and support 18 Gbps, 4k60 4:4:4 for the entire length of the cable.
 - d. Equipment that is not preapproved by the AV Consultant in writing will not be accepted and will be replaced with the approved equipment at no cost to the Owner.
- D. Audio Signal:
1. The equipment listed below is considered to be equal replacement parts for a point-to-point video solution as it relates to the system design intent. Equipment listed in section 2.4 override the equipment listed below.
 - a. Passive or Active audio summing adapter. Extron – ASA 131 or RDL – STA-1
 - b. Isolation transformer: RDL – EZ-HK1
- E. Cables grouped together shall be dressed in expandable nylon loom, similar to Techflex - Flexo
- F. Equipment Racks:
1. All AV equipment racks within this specification shall have the following accessories and/or features, either rack mountable or built into the rack, depending on the model of the rack. Refer to bid documents for all rack mounted equipment. Provide the following accessories as referred to in elevations. RUs are indicated in the elevations and noted with a # symbol in the part number.
 2. General Equipment
 - a. Shelving: Middle Atlantic – SS; 1RU shelf.

- b. Drawers:
 - i. Nonlocking: Middle Atlantic – D#
 - ii. Locking: Middle Atlantic – D#LK
- c. Header panel, located at the top of the rack, AV contractor to submit their logo to RCI for inclusion in the Header panel. If AV contractor has another company that makes the Header panel, provide that information to the AV Consultant.
 - i. RCI Custom – BNA001-200120MM-01
- d. Blank plates: Middle Atlantic – EB#
- e. Surge protection for all devices located within the rack. Surge protector shall be: 20 AMPs, rack mountable or mount to a side rail and at least 1,000 joules of protection.
 - i. Recommended Surge protector is Middle Atlantic – PD-920R-SP. Additional acceptable manufacturers are: Furman, Juice Goose, Triplite and SurgeX.
- f. Horizontal, vertical, and entry cable management.
 - i. All cabling shall be straight off of the back of equipment to horizontal supports connected to equipment rack. Cabling shall follow support to vertical supports when going into other components and/or out of the equipment rack.
 - ii. Cabling secured to other cabling and supported from the connector is not acceptable.
 - iii. Separate AC power and other signal types from each other.
- g. Provide 20 Amp rated power strips as necessary.
- h. Sequencers
 - i. Provide a Middle Atlantic – PDS-620R or Furman – CN-2400S Sequencer.
 - ii. All equipment racks with the following equipment shall have a sequencer within the equipment rack. AV integrator to follow industry standards when using sequencers.
 - 1. Amplifiers
 - 2. Video processors without control processors
- i. Active Thermal Management
 - i. Solid rear door.
 - ii. Fan kit totaling 190 CFM mounted on the top face of the equipment rack.
 - 1. Fan guards
 - 2. Recommended equipment: Middle Atlantic – QBP-2 Blower panel or Middle Atlantic – CAB-COOL50 Cabinet Cooler.
 - iii. Blank panels on the front of the equipment rack in all unused rack spaces.
 - iv. Solid blank panels in unused rack spaces in top six (6) racks spaces.
 - v. Stack power amplifiers with 1 open rack space between.

- vi. Provide active thermal management in the following equipment racks in the following systems.
 - 1. Multi-Purpose Room System
- j. Passive Thermal Management
 - i. Vented rear door with no less than 60% open area.
 - ii. Solid blank panels on the front of the rack in all unused rack spaces.
 - iii. Stack power amplifiers without open rack space between.
 - iv. Top of equipment cabinet to be open or vented.
 - v. Provide passive thermal management in all racks unless noted above.

2.4 EQUIPMENT REQUIRED PER ROOM TYPE

AV SYSTEMS PROGRAMMING			
TYPE	DESCRIPTION	MANFR.	MODEL NO.
	AV SYSTEMS PROGRAMMING ALLOWANCE REFER TO SECTION 3.3 FOR SCOPE OF PROGRAMMING	BNA CONSULTING	\$30,500.00 SYSTEMS PROGRAMMING ALLOWANCE
END OF SCHEDULE			

TODDLER & COMMUNICATION EQUIPMENT SCHEDULE			
TYPE	DESCRIPTION	MANFR.	MODEL NO.
CSA	CLASSROOM RF MICROPHONE SYSTEM, RF RECEIVER, TEACHER & HANDHELD MICROPHONE, LOUDSPEAKERS (C4)	AUDIO ENHANCEMENT	MS-700
TxH / Rx	DIGITALINX HDMI WALL PLAYTE EXTENSION SET. DECORA WALL PLATE SET WITH REMOTE POWER	LIBERTY/DIGITALINKX	DL-HD50C-WPKT-W
P1	3LCD, 5,000 lm, 1920x1080 WITH 4K ENHANCEMENT TECHNOLOGY (INCLUDE ELPMB75 MOUNT) COLOR BY ARCHITECT	EPSON	POWERLITE 810E WITH ELPMB75 MOUNT
END OF SCHEDULE			

LEARNING STUDIOS EQUIPMENT SCHEDULE			
TYPE	DESCRIPTION	MANFR.	MODEL NO.
R1	2X2 EQUIPMENT RACK, ABOVE CEILING 4 RU, RECESSED	FSR	CB-224
CSA	CLASSROOM RF MICROPHONE SYSTEM, RF RECEIVER, TEACHER & HANDHELD MICROPHONE, LOUDSPEAKERS (C4)	AUDIO ENHANCEMENT	MS-700

HDU KP3 CHD	DIGITALINX 'ARK' SERIES AV ROOM KIT WITH 4 HDMI INPUTS, USB 2.0 TRANSFER, CONTROLLER (KP3) AND SECONDARY HDMI / 3.5MM AUX INPUT.	LIBERTY/DIGITALINKX	DL-ARK-573-4HC-2W-KT
CS	WIRELESS COLLABORATION DEVICE (OFCI)	VIVI	VIVI PRO (OFCI)
	NETWORK SWITCH, MANAGED, PoE+, 125W (8) 1GB POE+ AND 2X1G +2SFP PORTS	NETGEAR	M4250-10G2F-POE+
CAM	PTZ CAMERA, 12x OPTICAL ZOOM, 80 DEGREE FIELD-OF-VIEW, Q-LAN CONNECTED, 1080P	QSC	NC-12x80
	UNIFIED CORE WITH 8 LOCAL AUDIO I/O CHANNELS, 64X64 NETWORK I/O CHANNELS WITH 8X8 SOFTWARE-BASED DANTE LICENSE INCLUDED, USB AV BRIDGING, DUAL LAN PORTS, VOIP, 8x8 GPIO AND 8 AEC PROCESSORS	QSC	CORE 8 FLEX
P1	3LCD, 5,000 lm, 1920x1080 WITH 4K ENHANCEMENT TECHNOLOGY (INCLUDE ELPMB75 MOUNT) COLOR BY ARCHITECT	EPSON	POWERLITE 810E WITH ELPMB75 MOUNT
SC1	WALL MOUNTED, MANUAL, 16X10, 113" SCREEN W/MATTE WHITE MATERIAL	DA-LITE	MODEL C WITH CSR 34730 w/ 6" BRACKET
END OF SCHEDULE			

SCIENCE/ART/CTE EQUIPMENT SCHEDULE			
TYPE	DESCRIPTION	MANFR.	MODEL NO.
R1	2X2 EQUIPMENT RACK, ABOVE CEILING 4 RU, RECESSED	FSR	CB-224
CSA	CLASSROOM RF MICROPHONE SYSTEM, RF RECEIVER, TEACHER & HANDHELD MICROPHONE, LOUDSPEAKERS (C4)	AUDIO ENHANCEMENT	MS-700
HDU KP3 CHD	DIGITALINX 'ARK' SERIES AV ROOM KIT WITH 4 HDMI INPUTS, USB 2.0 TRANSFER, CONTROLLER (KP3) AND SECONDARY HDMI / 3.5MM AUX INPUT.	LIBERTY/DIGITALINKX	DL-ARK-573-4HC-2W-KT
CS	WIRELESS COLLABORATION DEVICE (OFCI)	VIVI	VIVI PRO (OFCI)
	NETWORK SWITCH, MANAGED, PoE+, 125W (8) 1GB POE+ AND 2X1G +2SFP PORTS	NETGEAR	M4250-10G2F-POE+
CAM	PTZ CAMERA, 12x OPTICAL ZOOM, 80 DEGREE FIELD-OF-VIEW, Q-LAN CONNECTED, 1080P	QSC	NC-12x80

	UNIFIED CORE WITH 8 LOCAL AUDIO I/O CHANNELS, 64X64 NETWORK I/O CHANNELS WITH 8X8 SOFTWARE-BASED DANTE LICENSE INCLUDED, USB AV BRIDGING, DUAL LAN PORTS, VOIP, 8x8 GPIO AND 8 AEC PROCESSORS	QSC	CORE 8 FLEX
P1	3LCD, 5,000 lm, 1920x1080 WITH 4K ENHANCEMENT TECHNOLOGY (INCLUDE ELPMB75 MOUNT) COLOR BY ARCHITECT	EPSON	POWERLITE 810E WITH ELPMB75 MOUNT
DOC	WIRELESS DOCUMENT CAMERA, 4K RESOLUTION, MIRACAST CONNECTIVITY, 10x OPTICAL / 12x DIGITAL ZOOM	EPSON	DC-30
SC1	WALL MOUNTED, MANUAL, 16X10, 113" SCREEN W/MATTE WHITE MATERIAL	DA-LITE	MODEL C WITH CSR 34730 w/ 6" BRACKET
END OF SCHEDULE			

MULTIPURPOSE/STUDENT COMMONS EQUIPMENT SCHEDULE (1 OF 2)			
TYPE	DESCRIPTION	MANFR.	MODEL NO.
R1, R2	EQUIPMENT RACK, SLIDE OUT, ROTATING SYSTEM, 24" TALL, 19" DEEP, 12 RU	MIDDLE ATLANTIC	SRSR-4-12
	SHELF, PULL OUT, RACK MOUNT LATCHING, 1 RU	MIDDLE ATLANTIC	SS
	DRAWER, PULL OUT, RACK MOUNT LATCHING W/LOCK, 3RU	MIDDLE ATLANTIC	D3LK
	BNA LOGO BLANK PANEL, 1RU WITH RJ45 KEYSTONE JACK FOR SERVICE PORT AND PATCH CABLE TO ETHERNET SWITCH	RCI CUSTOM	BNA001-200120MM-01
RCO	RELAY CONTROLLED OUTLET (PROVIDE APPROPRIATE MODEL PER AMPERAGE AND CORDED/HARD WIRED RQUIRMENTS FOR EACH AMPLIFIER SHOWN)	MIDDLE ATLANTIC	RLM-20-1CA RLM30-L530-1 RLM30-L520-1 (PROVIDE APPROPRIATE MODEL PER AMPERAGE AND CORDED/HARD WIRED RQUIRMENTS FOR EACH AMPLIFIER SHOWN)
	SMART SEQUENCING POWER CONDITIONER, 20A, 9 OUTLETS	FURMAN	CN-2400S
CS	WIRELESS COLLABORATION DEVICE (OFCl)	VIVI	VIVI PRO (OFCl)
WMH	WIRELESS HANDHELD MICROPHONE, WIRELESS RECEIVER KIT	SHURE	QLXD24/B58 QTY: REFER TO PLANS
	WIRELESS BODYPACK TRANSMITTER W/LAVALIER MIC	SHURE	QLXD1 INCLUDE SHURE WL185 CARDIOD LAVALIER MIC
	ANTENNA SPLITTER	SHURE	UA221

M2D	AES-67/DANTE, 2-GANG WALL PLATE, WITH 2 CH INPUT, 2-XLR, 4 CH OUTPUT, 2-XLR, L/R 3.5mm	QSC	unDX2IO+
	HDMI AUDIO EXTRACTOR	EXTRON	HAE 100 4K Plus
TxH	WALLPLATE ENCODER, GIGABIT ETHERNET FOR 4K60 4:4:4 VIDEO, AES67 DANTE AND CONTROL, HDMI AND BLUETOOTH AUDIO INPUTS	VISIONARY SOLUTIONS	DUETE5-WP-BT
Rx	DUET SURFACE MOUNT DCODER, EXPANSION ETHERNET PORT, HDMI, USB-C, STEREO ANALOG AUDIO OUTPUTS	VISIONARY SOLUTIONS	DUETD-5
	NETWORK SWITCH, MANAGED, PoE+, 250W (48) 10GB PORTS,	NETGEAR	M4300-48X
KP1	SINGLE-GANG NETWORKED CONTROLLER	QSC	AXON C1
TP5	TOUCH PANEL, 5.5" DIAGONAL, POE WALL MOUNT	QSC	TSC-50-G3
TP7	TOUCH PANEL, 7" DIAGONAL, POE WALL MOUNT	QSC	TSC-70-G3

END OF SCHEDULE

MULTIPURPOSE/STUDENT COMMONS EQUIPMENT SCHEDULE (2 OF 2)

TYPE	DESCRIPTION	MANFR.	MODEL NO.
DSP	UNIFIED CORE WITH 24 LOCAL AUDIO I/O CHANNELS, 128X128 TOTAL NETWORK I/O CHANNELS WITH 8X8 SOFTWARE-BASED DANTE LICENSE INCLUDED, USB AV BRIDGING, DUAL LAN PORTS, POTS AND VOIP TELEPHONY, NO GPIO, 16 NEXT-GENERATION AEC PROCESSORS, 1RU. PROVIDE DEPLOYMENT AND SCRIPTING LICENSES.	QSC	CORE 110F-V2
1A, 1B, 1C, 1D	POWER AMPLIFIER, 4 CHANNEL X 300 WATTS (1200 TOTAL), 70V	POWERSOFT	QUATTROCANALI 1204 DSP
P6	LOUDSPEAKER, 6", PENDANT 120 DEGREE COVERAGE	JBL	CONTROL 67 P/T
P8	LOUDSPEAKER, 8", PENDANT SUBWOOFER	JBL	CONTROL 60 PS/T
T	FLAT PANEL TILT MOUNT, 14°, MAX 200LBS LOAD, 878 X 500 mm VESA, LANDSCAPE	CHIEF	LTM1U
A	LARGE FLAT PANEL SWING ARM MOUNT - 25" EXTENSION	CHIEF	PNRUB-G
D75	FLAT PANEL DISPLAY, 75" DIAGONAL, UHD 24/7 OPERATION, 350 NIT	PANASONIC	TH-75EQ1U
D86	FLAT PANEL DISPLAY, 86" DIAGONAL, UHD 24/7 OPERATION, 350 NIT	PANASONIC	TH-86EQ1U

L01	DIRECT VIEW LED, 2.5mm PIXEL PITCH, 700 NITS, 14 BIT COLOR DEPTH, 3500:1 CONTRAST RATIO, INDOOR, FRONT SERVICEABLE, INCLUDES MOUNTING KIT AND FACTORY COMMISSIONING.	ABSEN	K2.5 V3 QUOTE: BJ_81320241618_US
END OF SCHEDULE			

CONFERENCE / TESTING ROOMS/WAITING EQUIPMENT SCHEDULE			
TYPE	DESCRIPTION	MANFR.	MODEL NO.
T	FLAT PANEL TILT MOUNT, 14°, MAX 125LBS LOAD, 650 X 400 mm VESA, LANDSCAPE	CHIEF	MTM1U
D50	FLAT PANEL DISPLAY, 50" DIAGONAL, UHD 24/7 OPERATION, 350 NIT	PANASONIC	TH-50EQ1U
D65	FLAT PANEL DISPLAY, 65" DIAGONAL, UHD 24/7 OPERATION, 350 NIT	PANASONIC	TH-65EQ1U
END OF SCHEDULE			

PART 3 – EXECUTION

3.1 INSTALLATION OF AV SYSTEMS:

- A. Provide AV systems and ancillary equipment as indicated on drawings and in accordance with equipment manufacturer’s written instructions, the NEC, and with industry best practices.
- B. Coordinate all work performed by other contractors pertaining to the AV system, including raceways, electrical boxes and fittings.
- C. Video systems.
 - 1. HDCP:
 - a. All equipment within the signal path must be capable of processing HDCP-compliant material.
 - b. All switcher, scalers, transmitters, and receivers shall reflect the HDCP compliance of the endpoint/display(s).
 - c. HDCP shall be disabled in the switcher/scaler when a non-HDCP-compliant endpoint/display is used.
 - 2. EDID Strategy:
 - a. Permanent video sources shall be set manually within the equipment to output their native resolution. Video properties shall not rely on EDID.
 - b. Portable video sources and wall plates shall use EDID tables within the switcher/scaler for preferred video properties. The EDID table shall be set with the following settings:

- i. Most common resolutions within the display's aspect ratio.
 1. 3840 x 2160 (UHD) 60Hz, 4:4:4 Chroma sample
 2. 3840 x 2160 (UHD) 60Hz, 4:2:0 Chroma sample
 3. 3840 x 2160 (UHD) 30Hz, 4:4:4 Chroma sample
 4. 1920 x 1200 (WUXGA) 60Hz
 - ii. Audio: refer to control section for audio requirements. This will include mono, Stereo, Surround sound, etc.. All audio will be 44,100 Hz, 16 bit unless otherwise noted.
- D. Pathway Requirements:
 1. General:
 - a. All pathways shall be designed, constructed, grounded and installed in accordance with all recommendations delineated within TIA 569-B and Standard TIA 942.
 - b. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. Field coordinate alternate pathway requirements with other trades onsite. New pathways shall not exceed distance limitations defined within this specification. Notify the Engineer of the changes for final approval prior to proceeding with the change.
 2. Conduits:
 - a. Contractor shall provide a minimum of 1-1" EMT conduit from device to accessible ceiling space unless otherwise noted. Then utilize non-continuous cable support from devices to connecting device. Refer to AV symbol schedule for specific conduit requirements.
 - i. Provide non-continuous open top cable supports every 5' above accessible ceiling.
 - b. Provide conduit from device to device in open and/or exposed ceilings. Ceilings with clouds are considered open/exposed ceiling.
 - c. Achieve the best direct route parallel with building lines with no single bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.
 - d. Provide large radius elbows on all bends.
 - e. Conduit runs shall not have continuous sections longer than 100 feet without a pull box. Refer to rough-in schedule for conduit fill capacity.
 - f. AV conduits should not be routed over or adjacent to heat sources such as boilers, hot water lines, or steam lines. Neither should they be routed near large motors, generators, photocopy equipment, or electrical power cabling and transformers.
 - g. After installation, conduits shall be clean, dry, unobstructed, capped for protection, labeled for identification, reamed and fitted with bushings.
 - h. A 200lb pull cord (nylon, 1/8" minimum) shall be installed in any empty conduit.
 3. Open Top Cable Support Requirements:

- a. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables
 - b. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
4. Pull Box Requirements:
- a. NEC sized pull boxes are not acceptable. Follow BICSI and EIA/TIA 569-B guidelines for pull box sizing.
 - b. Provide pull boxes in sections of conduit that are 100 feet or longer, contain more than two 90 degree bends, or contain a reverse bend.
 - c. Conduits that enter a pull box from opposite ends should be aligned.
 - d. Pull boxes shall have a length 12 times the diameter of the largest conduit.
 - e. All pull boxes must be accessible.
- E. Cabling System:
1. Follow T568B scheme for copper category cabling terminations.
 2. Provide a minimum 6" service loop in each AV system junction box. Cables shall be coiled in the in-wall boxes if adequate space is present to house the cable coil without exceeding manufacturers bend radius.
 3. In a false ceiling environment, a minimum of 3 inches shall be maintained between cable supports and false ceiling. At no point shall cable(s) rest on lay-in ceiling grids or panels.
 4. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
 5. Cables shall not be attached to ceiling grid seismic support wires or lighting fixture seismic support wires. Where support for AV cable is required, the contractor shall install appropriate carriers to support the cabling.
 6. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
 7. Pulling tension for balanced twisted pair shall not exceed 25lbf and for optical fiber shall not exceed 50lbf.
 8. Pair untwist at the termination shall not exceed 0.125". The cable jacket shall be maintained as close as possible to the termination point.
 9. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.
 10. Group multiple cabling together with expandable nylon loom, similar to Techflex - Flexo, when cabling exists a cavity and connects to a device. Cabling within a lectern, podium or millwork shall have expandable nylon loom sleeve as well.
- F. Grounding System:
1. All grounding and bonding shall be done according to ANSI J-STD-607-A, TIA 942, and NEC.

2. All cabinets/racks shall utilize paint piercing grounding washers, to be used where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack.
 3. All racks shall further utilize a full-length rack ground strip attached to the rear of the side rail with the thread-forming screws provided to ensure metal-to-metal contact. Similar to Panduit RGS.
 4. All active equipment shall be bonded to ground. If the equipment manufacturer provides a location for mounting a grounding connection, that connection shall be utilized. All active equipment shall be bonded using the appropriate jumper for the equipment being installed using the thread-forming screws. Similar to Panduit RG.
 5. Racks shall have individual, appropriately sized conductors bonded to the grounding backbone. Do not bond racks or cabinets serially – daisy-chained rack grounds will not be accepted.
 6. Refer to electrical diagrams for additional ground connection requirements.
- G. Cabling groups and conduit separation:
1. Refer to “CABLING GROUPS AND CONDUIT SEPARATION SCHEDULE”, located on the drawings
- H. Firmly secure all equipment in place that is not intended for portability.
- I. Mount projectors permanently and provide mechanical index ensuring precise alignment of the projected image.
- J. Provide adequate structural support for AV system components. Provide fastenings and supports with a safety load factor of at least five.

3.2 LABELING

- A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and wall plates. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
- B. All AV pathways, cables, connecting hardware, equipment, racks, patch panels, outlet/connectors, and grounding system shall be labeled in accordance with TIA/EIA 606-A.
- C. All labels shall meet UL 969 requirements for legibility, defacement and adhesion requirements. Handwritten, Ink, or Laser Printing labels are not allowed. Labels shall be uniform in physical size and text height with minimal blank space. Provide labels using thermal transfer print. Heat shrinking or wraparound labels are required, flag style labels are not allowed.
- D. Provide laminated plans (minimum size 11x17) of all AV as-built plans (including one-line diagrams) in each and every AV Rack.
- E. Label each equipment with the date (month/year) that it was installed along with the IP address, if applicable, and equipment type.

3.3 CONTROL SYSTEM FUNCTIONALITY:

- A. GENERAL:
1. The control processing and digital signal processing programming required for AV

sub-systems as defined in section 2.4 of this specification shall be completed by BNA Consulting.

- a. The General AV sub-systems require configuration and are not included in BNA's programming scope of work.
 - b. Configuring of system components will be part of the Contractors scope of work. Contractor shall provide IP address, MAC address, Serial numbers, etc to BNA for coordination with the program.
 - c. IP address will be coordinated by the programmer and shared with contractor for implementation into specific devices.
 - d. If the contractor chooses to provide their own programming services, it must match the functional intent as defined by BNA Consulting exactly. No exceptions.
2. The successful bidder for this specification section (27 4100) shall contract BNA Consulting for performance AV programming services.
- a. The allowance defined in section 2.4 for the performance AV systems programming services shall be included in the bid as a line item.
 - b. Contracting shall take place once shop drawings are submitted. The Programming phase shall begin upon final review of AV contractor shop drawings.
3. Control programs & DSP configuration programs shall be designed to match the schematic system wiring as shown in approved shop drawings.
4. The AV contractor must field wire each system in accordance with the final reviewed shop drawings.
- a. Any deviations made to shop approved shop drawings will be subject to additional programming service fees.
5. Before programming services commence, the AV contractor shall confirm that all connections are complete, and all equipment is powered up and functional.
- a. Written documentation including site progress photos shall be provided to BNA Consulting prior to commencement of the programming phase.
- B. PROGRAMMER SCOPE OF WORK:**
1. Configuration:
 - a. Network switch
 - b. Control Processor and devices with a fully functional controller
 - c. DSP
 - d. Touch panel / keypad
- C. ROOM FUNCTIONS:**
1. All room controls are required to have the similar looks and functionality.
 2. Multi-Purpose Room / Student Commons controls/functionality
 - a. All inputs and outputs shall be coordinated with AV riser diagram.
- D. Amplifiers shall be set to go to stand by after 30 minutes of no audio detection.**

3.4 CYBER SECURITY

- A. Contractor shall change all default username and passwords for all network devices**

provided. A Strong Password should include at a minimum the following:

1. Be at least 12 characters in length
 2. Contain both upper and lowercase alphabetic characters (e.g. A-Z, a-z)
 3. Have at least one numerical character (e.g. 0-9)
 4. Have at least one special character (e.g. ~!@#\$\$%^&*()_-=)
 5. Cannot contain full words
- B. No written username or passwords shall be located in any areas of installation.
- C. Network devices to be set up on a separate network other than owner's LAN ensuring no internal or external users can access system without authorization.
- D. Follow manufacturers hardening guide and use best industry practices to secure network and devices provided by contractor and associated with system.

3.5 FIELD QUALITY CONTROL:

A. TESTING:

1. Refer To Section 27 4101 For Additional Requirements.
- B. At the time of final commissioning, if the AV consultant determines that the systems are not sufficiently complete to do a final punch list, and was not notified at least three (3) days prior to the visit, then a return visit will be required. The AV Consultant's return visit will be paid for in advance by the AV integrator at a flat rate of \$1,200 per person, at no cost to the owner.

3.6 OPERATING AND MAINTENANCE MANUALS: Refer to Section 26 0502 for requirements.

3.7 TRAINING:

- A. Provide two (2) sessions of two (2) hours each of training on the operation of each system, at job site, at no cost to owner. Systems shall be complete and have been finalized by the AV Consultant prior to training.
- B. Training shall be recorded using a video recording device that support a minimum resolution of 1080P/60 with an integrated microphone connection for an external microphone and a camera tri-pod mount. Presenter shall be wearing a lapel microphone that connects to the recording device and a Tri-pod shall be used for stabilizing the recording device. Recordings that are shaky, poor audio and/or video quality, incomplete, or other issues will not be accepted and the contractor will be responsible for providing a new recording and training within five (5) business days of notification. Provide a digital copy, in MP4 format, on a USB flash drive to the Owner and AV Consultant. Also locate a USB flash drive with the training videos, programing, etc. in the as-built drawer of the main equipment rack. Digital copies sent as a link are not acceptable. identify within the Operating and Maintenance manuals, in the first section, where the flash drive is stored. Clearly label the flash drive as training videos. The second training shall take place within two months of the first training and all questions shall be answered.

3.8 RECORD DRAWINGS: Refer to Section 26 0502 for requirements.

END OF SECTION 27 4100

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SECTION 27 4101 - AUDIOVISUAL SYSTEM INTEGRATOR VERIFICATION CHECKLIST

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-27 4100 section apply to work specified in this section.

1.2 ADMINISTRATIVE REQUIREMENTS:

- A. This Document is intended to be completed and supplied to the AV Consultant prior to the final punch visit. Refer to specification 27 4100 for system components.
- B. Installing contractor shall make copies of this document for large systems. Include all copies in the O & Ms and provide all copies to the AV Consultant.

1.3 DESCRIPTION OF WORK:

- A. Refer to “INTEGRATOR VERIFICATION CHECKLIST” at the end of this section, for system verification requirements. Fill out the form and return to the AV Consultant prior to the final punch.
- B. Upon completion of installation of each system and after electrical circuitry has been energized, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units on site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with testing.
- C. Before inspection by owner and AV Consultant, and after completion of the installation, conduct system tests and make necessary corrections for proper system operation.
- D. Adjust, balance and align equipment for optimum quality and to meet the manufacturer’s published specifications.
- E. All limiters and/or compressors shall be set to prevent operators from over-adjusting sound levels and damaging system components, while maintaining the highest amount of gain possible.
- F. System shall have no audible hum, noise, RFI, or distortion when operating under normal conditions. System shall reproduce material at the loudspeakers rated output level without audible distortion. All input levels shall be pre-set so system may be operated without causing unstable feedback under normal use.
- G. System shall have no image distortion, hum bars, color shift, or any other picture distortion while operating under normal conditions. Provide cable equalizers or an HDBaseT video solution. Cable equalizer shall be located near display and powered, on all cables that are more than 30 feet in length or with more than four (4) connection points. Refer to section 2.3.B in this specification for a list of pre-approved equipment. Adjust gain controls for optimum signal-to-noise with 0 dBu at a line-level input.
- H. Perform polarity checks of loudspeaker lines by means of a polarity tester or use DC source at one end of each line and a voltmeter at the other end. Loudspeaker lines shall be identically polarized with respect to color coding.
- I. Loose parts and poor workmanship or soldering shall be replaced.
- J. Sweep Loudspeaker systems with high-level sine wave or 1/3 octave pink noise source. Correct causes of buzzes or rattles related to Loudspeakers or enclosures. Notify owner of external causes of buzzes or rattles.

- K. Equalize the loudspeakers to produce less than 6 dB total variation between 500 Hz and 8000 Hz (+/- 3 dB).
- L. Contractor shall provide system testing as described herein using up-to-date and industry accepted test equipment appropriate to the types of links being tested and in accordance with the latest edition of IEC 61935-1. AV Contractor shall own and have access to a handheld Quantum Data 780C tester to allow for on-site verification testing and troubleshooting of HDMI and digital video networks and analog video displays. All test equipment used shall be factory calibrated within one year of use with references set daily prior to testing.
- M. Contractor shall provide HDCP compliant device with digital cables, and digital HDCP content for testing of routing and HDCP compliant distribution and switching. Also provide analog VGA output equipment for testing of video switching, scaling, and distribution if analog is included with this project.
- N. Horizontal cabling contractor shall test all twisted pair cabling used within the AV system following the standards in specification 27 1500 under the testing section. Provide documentation of testing to AV Consultant prior to final walk through.

PART 2 – PRODUCTS

2.1 SECTION NOT USED

PART 3 – EXECUTION

3.1 AUDIOVISUAL SYSTEMS INTEGRATOR VERIFICATION CHECKLIST

Project Title		Date	
City, State		Integrator	
Room/Area			

Audio/Video Signal Processors/Switchers					
Location	Rack #	Manufacturer & Model #	Serial #	Total Channels (In, Out)	Unused Channels (In, Out)

Power Amplifiers						
Location	Rack #	Amp #	Manufacturer & Model #	Serial #	Total Channels	Watts/Channel

Loudspeakers Zones							
Location	Rac k #	Amp #	Amp Chan	Manufacturer & Model #	Serial #	Calculated Impedance	Measured Impedance

Wireless Microphone Receivers					
Location	Rac k #	Manufacturer & Model #	Serial #	Usable Frequency Range	Chosen Frequency

Portable & Miscellaneous Equipment			
Description	Location	Quantity	Manufacturer & Model #.

Sign below to confirm you have received portable & miscellaneous equipment listed above.

Owner Signature: _____

Date: _____

Title: _____

Personal Delivering Equipment: _____

General Items

Title	Description	Initial	Notes
Labeling	Verify that all cabling, equipment, and wall plates are labeled per specifications and as noted on drawings		
Cable management	Verify that proper cable management has been provided and that everything looks well-ordered.		
Power	Verify that power supplies are secured and in an accessible area.		
Sequencer	Verify that the sequencer(s) are setup correctly for industry standard power on/off function.		
Cyber Security	Verify that all default passwords have been changed. Provide all login information to the owner representative		
System testing	Verify that all systems have been tested and are in working order.		
System Certification	Verify system has been tested with industry standard testing equipment including the use of Quantum Data 780C		
Cabling	Verify that all cabling on the project meets the document requirements.		
Network	Verify that the owner has all of the needed information for all devices on the network. Provide this information to the owner via a spread sheet.		
Network	Verify that all IP address are within the owner's network scheme.		
Network	Verify that VLANS are setup as indicated in drawings and within owner's network infrastructure		
System One-lines	Verify that each equipment rack contains a set of one-lines diagrams for system installed. Refer to specifications for one-line requirements.		
Thermal Management	Verify active thermal management is setup correctly and working properly.		
Training	Verify training has been scheduled with the owner representative.		

Audio Performance

Title	Description	Initial	Notes
Audio Signal Distribution	Verify that audio signal is being transported and distributed according to project documentation.		
Phantom Power	Verify that the correct phantom power is provided at the correct locations according to project documentation.		
Gain Before Feedback	Verify that the audio system is capable of reproducing speech above nominal operating levels without audible distortion or feedback.		
Rough Balance (input)	Verify that all inputs have the same nominal level.		
Gain Structure	Verify that proper gain structure has been followed from each input to output		
Rough EQ	In systems with equalization capability, equalize the loudspeakers to produce less than 6 dB total variation between 500 Hz and 8000 Hz (+/- 3 dB).		
DSP Programming	Verify that DSP systems have been programmed to allow signal routing, balance, and EQ. DSP programming should be saved in editable form prior to final commissioning visit.		
Rough Balance (output)	Verify that loudspeaker zones reproduce program content at the same level (+/- 1 dB).		
Emergency Muting	Verify that any required muting or operational changes are in accordance with location regulations in the event of a life safety or similar emergency.		
Assistive Listening	Verify that the assistive listening system functions as a complete personal listening system at specified levels without distortion or excessive background noise.		
Loudspeakers	Verify that there is no hum, noise, RFI, or distortion when operating under normal conditions.		
Loudspeakers	Verify that there are no rattles or buzzes with a high-level sign wave or 1/3 octave pink noise.		
Loudspeaker Zoning	Verify that loudspeaker zones are assigned correctly according to project drawings and specifications.		
Loudspeaker Impedance	Verify that all loudspeaker circuits have correct impedance as defined		

	in the project drawings and specifications. Note measured impedance on previous page.		
Loudspeaker Alignment	Verify that loudspeakers are mounted and aligned as shown in project documentation.		
Loudspeaker Polarity	Verify that all loudspeakers in a given space are wired with the same polarity.		
Loudspeaker Tap Settings	Verify the tap settings on all constant voltage loudspeakers.		
Loudspeaker Delays	Verify that loudspeakers are set with the proper delay. Refer to drawings and specifications for requirements		

Control System Performance

Title	Description	Initial	Notes
Functionality	Verify that the control system functions according to project documents.		
Automatic controls	Verify that the automatic features work ie: room combining, video detection, etc..		
Lighting controls	Verify that the lighting system presents are correctly recalled by the control system as indicated in project documents.		
Shade controls	Verify that the shade controls are correctly recalled by the control system as indicated in project documents.		
Sequencer	Verify the sequencer is controlled as noted in project documents. If no specific requirements are noted, sequencer will be powered on/of from the front panel.		

Video Performance

Title	Description	Initial	Notes
Video Routing & Switching	Verify that all video signals are properly routed, switched, scaled, and displayed according to project documents.		
Projector Alignment	Verify that projectors and screens provide a projected image that is properly aligned and fills the projection area.		
Projector Alignment	Verify that projector and screen are in the correct locations, correctly aligned and keystone correction is not in use.		
Projector Interactivity	Verify that projector touch sensors are calibrated and working per manufacture instructions. Provide offset hardware as needed.		

Image Scaling	Verify that all displayed images are scaled to the full native resolution of displays and projectors in all cases where scaling hardware is specified.		
Image Quality	Verify that all displayed images are correctly focused and are free from distortion.		
Aspect Ratio	Verify that all displayed images maintain the proper aspect ratio and image geometry. Key-stoning and stretching should not be used. Any exceptions to this should be noted.		
Display Image setting	Displays are set to dot to dot or full. Images shall fill the screen without cropping.		
Signal Bandwidth	Verify that all equipment from endpoint to endpoint supports the resolution/data rate as indicated in the documents.		
System Certification	Verify system has been tested with industry standard testing equipment including the use of Quantum Data 780C		

3.2 OPERATING AND MAINTENANCE MANUALS: Include a copy of this document within the Operation and Maintenance Manuals.

END OF SECTION 27 4101

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SECTION 27 5123 - INTERCOMMUNICATION SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26, 27 & 28 basic materials and methods sections apply to work specified in this section.
- C. Refer to specification 26 0553 conduit and junction box color requirements.
- D. Refer to specification 27 1500 for category and/or optical fiber cable and connectivity specifications.
- E. All unshielded category 'UTP' and/or optical fiber cable, for AV equipment, used on this projector shall match the horizontal cabling within the building.
 - 1. Category cables used for transporting video, audio and controls simultaneously from transmitters to receivers and/or switchers shall follow the Manufacturer's recommend cabling specifications.
 - 2. Division 27 1500 shall provide installation and execution requirements for all category and/or optical fiber cabling and connectivity required within the audiovisual system

1.2 ADMINISTRATIVE REQUIREMENTS:

- A. Bid Submittal:
 - 1. Equipment Costs: Breakout cost of material and labor as different line items.
 - 2. Provide separate line items for each section that you are being bid on.
 - a. Contractor shall not provide a single number with all of the sections/scopes combined.
- B. All bids shall be based on the expansion of the school district's existing Intercommunication and Bell Schedule Server Systems and must be compatible with Audio Enhancements - Epic System - No Exceptions. Equipment as specified herein is part of the Epic System.
 - 1. Contractor wanting to bid on IP intercom alternate shall submit eight (8) working days prior to bid the system they intend to provide. System shall meet all requirements listed below with no exceptions.
- C. Coordination:
 - 1. Coordinate final inspection of the systems installed, with Audiovisual (AV) Consultant, three (3) weeks in advance.
 - 2. Obtain GANTT chart for construction time frame from the General Contractor.
 - 3. Coordinate with Electrical contractor to meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate the mounting condition of all ceiling-mounted AV equipment with ceiling type. During second meeting, coordinate the location of all ceiling-mounted AV equipment in each area.

4. Meet at least once with the mechanical installer prior to fabrication and installation of duct work. Coordinate depth and location of all loudspeaker and duct work in all areas.
5. Meet with Electrical contractor prior to pathway rough-in to coordinate Intercom system requirements in each area.
6. Meet at least once, prior to rough-in, with horizontal cabling installer to verify all required drop points are accounted for. Coordinate cable color according to specification 26 0553 and 27 1500.
7. Coordinate all AV system components within millwork/furniture with millwork shop drawings prior to rough-in.
8. Meet at least twice with owner to coordinate network requirements. Hold the first meeting before submittal of shop drawings to coordinate network protocols, including but not limited to: IP address schedules, MAC address schedules, patchbay schedules, security requirements, and VLANs. Hold the second meeting prior to system deployment.
9. Meet at least twice with owner to coordinate security system integration. Hold the first meeting before submittal of shop drawings to coordinate microphone placement and security tie in requirements. Hold the second meeting prior to system deployment.
10. Coordinate color (including custom color) and finish of all AV system components with Architect prior to ordering. Architect may require custom color of grills, face plates, etc.. Intercom contractor shall paint or have devices painted by others. The cost for custom colors shall be within the Intercom Contractors Bid.
11. Coordinate all system components within millwork/furniture with millwork shop drawings prior to rough-in.

1.3 DESCRIPTION OF WORK:

- A. The work covered by this section of the specifications shall include all material, labor, hardware, software, firmware and programming to install a completed and operating system as described herein and shown in the drawings. The system shall utilize the schools shared data network, and not require the use of any proprietary switches, routers, or other network components. Beyond the shared data network hardware, the rest of the system shall be complete with all necessary materials, labor, hardware, software, firmware and programming specifically tailored for the installation. It shall be possible to permanently modify the software on site by using a system administrator software network interface.
- B. This section includes a fully operational IP platform for school internal communications system incorporating school safety notifications and general communications including but not limited to the following:
 1. Classroom systems and common zone network interfaces shall be capable of utilizing standard Category based infrastructure, Category 6 or better, for installation from the intermediate distribution frames only to the classroom and/or zone, allowing for only one type of wiring infrastructure within the school. Distribution of all voice signaling shall utilize a shared or dedicated IP network.
 2. The platform shall provide complete internal communications employing SIP (Session Initiation Protocol) including the minimum functions listed.
 - a. Integration with any VoIP telephone system using SIP type integration. It shall allow the school(s) to upgrade or replace their telephone system without requiring the owner to replace, or lose any feature of, their internal communications (intercom) system.

- b. Support a SIP trunk from the building's VOIP phone system to provide hands free two-way communication from all administrative telephones to any location equipped with a talkback speaker or audio system with room microphone
 - c. Provide its own SIP environment, and in the case of a failure of the schools VoIP telephone system, be capable of operating completely independently for all functions, except access from the handsets connected to the schools VoIP system.
 - d. Access remote classrooms (trailers, temporary classrooms etc.) via IP interface or room audio system with room microphone. It shall provide intercom, class change tones, emergency tones, and normal / emergency paging via a wired network to these remote locations.
 - e. Integrate with the classroom sound amplification system (CSAS) and utilize the same loudspeakers as the CSAS.
3. Emergency announcement that will override any pre-programmed zones assuring that all Emergency/Lockdown etc., are heard at each and every loudspeaker location.
4. The system shall be a software-controlled system, whose primary interface is a web-based portal, accessible from any authorized computer.
5. Provide a map-based user interface. All major functions, including intercom, paging, notifications and alerts shall be done using the map as the foundation for those actions.
6. Bell Event announcement
 - a. Bell Schedules shall be easily assigned to days and changed simply with authenticated access to the system through any browser-based device.
 - b. Provide a simple calendar-based scheduling system for bells. It shall provide the ability to have an unlimited number of bell schedules.
 - c. Provide a calendar-based scheduling up to four years in advance. The system shall be capable of displaying a fully year calendar and differentiating which bell program is scheduled to run on each day in an easy-to-read format. The calendar shall be based on a standard school year and provide a selectable start month.
 - d. Provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone within the facility or outside the facility to any other location within the facility or district.
7. Capability of prerecording normal/emergency announcements that can be activated by a Soft Key or via a dedicated call-switch.
8. The system shall utilize a shared data network (VLAN enabled) or dedicated network as means of distribution for all voice overhead paging, emergency paging, emergency tones, intercom, and class change tones.
9. The system shall provide two I/O Ports on each classroom network interface, and common zone network interface which can be used as programmable inputs or outputs to control contact closures. Contact closures can be activated manually to turn on cameras, unlock doors, emergency lockdown, etc.

10. The system shall provide a flexible and robust event engine, and in addition to pre-programmed events and actions, the event engine shall be capable of accepting Java based programming to accomplish advanced integrations and functions.
 11. The system shall automatically broadcast emergency instructions throughout the entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions shall be preprogrammed and require no user intervention. The system shall provide a redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
 12. The system shall have the capability of maintaining a record of all alerts that are received and provide appropriate school personnel the capability to enter information about the alert, which shall be maintained in the systems database. That information shall also be made available to appropriate school personnel in the form of a report that shows all alerts that have occurred, their date, time, and the end alert information.
- C. Equipment submitted in bid proposal that has not been approved by AV Consultant in writing will not be accepted and shall be replaced by approved equipment at contractor's expense. Equipment not listed within this specification, or contract documents, that are required for a complete and working system, shall be of professional grade and used in the same manner as needed for a complete and working system.
- D. Input plates shall match the color and style being used throughout the project.
- E. Contractor is responsible for coordinating with all other trades for equipment locations, mounting requirements, supports and plenum space requirements.
- F. All cabling shall be installed in a minimum of 1" conduit to accessible ceiling space unless otherwise noted. Provide conduit to accessible ceiling space and then utilize non-continuous open top cable supports every 5'.
- G. Intercom contractor shall participate in a mandatory pre-construction meeting no more than sixty (60) days prior to ordering equipment, and before work can begin. Contractor is responsible for coordinating meeting. The meeting will be held at AV Consultant's office. All submittals, shop drawings, and bill of materials shall be completed and submitted to AV Consultant for review eight (8) working days prior to this meeting.
1. Intercom contractor shall attend the electrical pre-construction meeting per specification 26 0500.

1.4 QUALITY ASSURANCE:

- A. Manufacturers:
1. Firms regularly engaged in manufacture of sound equipment, components and accessories, of types, capacities and characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years. Equipment supplier shall be authorized representative of the manufacturer of each major piece of equipment and be currently authorized by the manufacturer to furnish, install and service that particular equipment.
 2. System shall be compatible with the districts security system.
- B. Installer:
1. Qualified with at least 5 years of successful installation experience with similar systems.

2. Integrating firm shall have worked satisfactorily for a minimum of (5) years of completing systems equal to this scope, quality, type and complexity.
 3. Key personnel assigned to the project shall each have minimum of (10) years of experience in completing systems equal to this scope, quality, type and complexity.
 4. Contractor shall be a factory authorized distributor of all equipment specified for the geographical area of the project.
 5. Contractor shall maintain complete installation and service facilities for the duration of the project contract.
 6. Contractor shall have current manufacturer certificates for system and equipment listed within this specification.
 7. All contractors bidding on this project must have local representation that is within 4 hours of the job site.
- C. Contractor must follow the standards described within:
1. BICSI/AVIXA AV Design Reference manual.
 2. ANSI/AVIXA 2M-2010 Standard guide for Audiovisual Systems Design and Coordination Processes.
 3. ANSI/AVIXA 10:2013 Audiovisual Systems Performance Verification Guide.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- E. Comply with NFPA 70 and with NEMA Standard SB-40 for Emergency Communications in K-12 schools.
- F. Comply with UL 60950.
- 1.5 SUBMITTALS: Refer to Section 26 0502 for requirements.
- 1.6 WARRANTY:
- A. Systems shall be guaranteed for a period of one (1) year from the date of substantial completion against defective materials, inferior workmanship or improper installation adjustment. Guarantee shall cover all parts and labor.
 - B. If system failure causes audiovisual system to be inoperative or unusable for its intended purpose, contractor, when notified of the problem, shall repair system so it will be operational and usable within three (3) business days. If defective components cannot be repaired in time, provide temporary equipment as required.
 - C. Contractor shall supply one (1) year warranty on all system programming from the date of substantial completion. During this time period, upon owner request, the contractor shall provide programming changes up to four (4) sessions free of charge. During this time the programs shall be password protected. At any time during the one (1) year, the owner can terminate the warranty and request the programming of each system. At this time the programs are to be turned over to the owner and all passwords are to be removed. The owner shall own all rights to the programming after this time, to be used in this facility.
 - D. Contractor shall honor equipment warranties for term established by manufacturer if greater than warranty time frame mentioned above. Equipment for the project shall not be purchased until ready to be installed/programmed. Manufacturer warranties for this project shall extend more than 2/3rd of their term past substantial completion. Example, a three (3) year manufacturer warranty shall have more than two (2) years left once

substantial completion has occurred.

- E. Prior to the end of the one (1) year warranty. The Intercom Integrator shall perform the following:
1. Three (3) months prior to end of warranty remind the owner and AV Consultant that the end of the warranty is approaching. At this time coordinate the events below with the owner and notify the AV Consultant of the time of the walk through(s).
 2. One (1) month prior to end of warranty, walk through campus and verify all components are working. Supply list of components with location, type equipment and status to the AV Consultant and Owner. Correct any and all malfunctions as necessary.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. The platform shall utilize IP network Technology, Call-in Notification, School Paging and Evacuation tones, IP infrastructure, Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone, Two-way hands-free Internal Intercommunications and Paging, and Program Distribution. The system shall be easy to learn and operate. All standard programming shall be web based and user friendly to allow the system administrator the ability to easily program system features.
- B. Provide complete and satisfactorily operating school communications and school safety as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.
- C. Each Classroom shall be provided with a call-in momentary contact button, microphone, and integration with classroom sound amplification system.
- D. All main components and software shall be distributed from (1) manufacturer and be a complete system. This includes; Software and IP Endpoints, excluding the VoIP telephone system.
- E. Intercom paging system power and network intercom interface:
1. Shall allow users to install intercom paging systems spanning multiple building or facilities connected through a VLAN. Provide a 100/1000 Ethernet switch port configured on a dedicated VLAN.
 2. All Network interfaces used in the classroom and for the common zones shall be powered via PoE from the district provided network switches.
 - a. PoE switches and network cabling from MDF (Main Distribution Frame) and IDF (Intermediate Distribution Frame) to devices provided by others.
- F. All network switches shall include an uninterruptable power source to provide adequate runtime. In the event the school has a generator the UPS systems shall hold the switches long enough until generator power can be provided. Customer to provide all necessary UPS for network switches.

2.2 SYSTEM FUNCTIONS/SOFTWARE

- A. Server and Server software:

1. Software-controlled system, whose primary interface is a web-based portal, accessible from any authorized computer. The system shall support being deployed on physical server hardware.
 - a. The system shall utilize a 1U rack server, operating as an appliance, and dedicated to the operation of this system only.
 - b. The entire system shall be Linux based.
 - c. (4) HDD Bays with (2) 240 GB SSD drives in a RAID 1 configuration
 - d. Dual 1 Gbps Ethernet ports, 1 dedicated server on board management NIC/ethernet port.
 - e. Intel Xeon Processor 3.5 GHz with 16 GB DDR4 2400 MHz RAM
 - f. Redundancy:
 - i. RAID1
 - ii. Dual power supplies
 - iii. Hot swappable hard drives.
2. The system shall be based on standards compliant SIP and RTP communications across the network and shall allow direct Trunk Integration to the VoIP telephone system.
3. The system shall provide a simple calendar-based scheduling system for bells. It shall provide the ability to have an unlimited number of bell schedules.
4. Provide a map-based user interface. All major functions, including intercom, paging, notifications and alerts shall be done using the map as the foundation for those actions. Paging shall clearly show on the map where the page audio will be transmitted to.
5. The system shall support utilizing a shared data network and support (VLAN [Virtual Local Area Network] enabled) or dedicated network as means of distribution for all voice overhead paging, emergency paging, emergency tones, intercom, and class change tones. System shall support routing of traffic across multiple subnets and network segments.
6. Bell Event announcement.
 - a. Bell Schedules shall be easily assigned to days and changed simply with authenticated access to the system through any browser-based device.
 - b. Provide a simple calendar-based scheduling system for bells. It shall provide the ability to have an unlimited number of bell schedules.
 - c. Provide a calendar-based scheduling up to four years in advance. The system shall be capable of displaying a fully year calendar and differentiating which bell program is scheduled to run on each day in an easy-to-read format. The calendar shall be based on a standard school year and provide a selectable start month.
 - d. Provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone within the facility or outside the facility to any other location within the facility or district.
7. The system shall automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions shall be preprogrammed and

require no user intervention. The system shall provide redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems

8. User access:
 - a. Provide discreet control over roles for the system. Roles shall be definable down to the individual feature level and provide the district with the ability to restrict or grant access to any roll individual features or groups of features.
 - b. Web based administration programming tool which allows the administrative personnel to easily manage audio sources, class change schedules, paging groups, time updates, holiday schedules and day/night mode operation from a web browser.
 - c. Fully integrated with the school's existing LDAP or active directory system.
 - d. Be based on a database structure, utilizing a robust commercially available database such as SQL.
 - e. Provide web browser access to the system specifically for a teacher. Teacher access shall be assigned through LDAP or active directory. The teacher screen shall provide information specific to the room that the teacher is assigned to. That information shall consist of, but not limited to, the next scheduled event for the room (Bell, Announcement, etc.), teacher name, room number, an intercom call button, and an emergency call button.
 - f. Provide for a complete personal alert function for each teacher. The alert functionality shall be an integrated part of the administrative head end software and shall not require any separate application or hardware to support this functionality.
 - i. The teacher personal alert functionality shall be integrated into the classroom microphones and the teacher web screen.
9. Have the ability to synchronize to the same NTP server utilized for the Master Clock system.
10. Ability to monitor operations and functions of the system.
11. Provide web-based off-site programming and diagnostics of the system. It shall also be capable of determining basic circuit faults.
12. Provide the ability for the school to upload their own recorded files for both Bell Tones, and Notifications.
13. The system shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone within the facility or outside the facility to any other location within the facility or district.
14. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any speaker in the system. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A pre-announce tone shall sound immediately before the intercom path is opened.
15. Display the location of the alert on the map in the case of a wireless microphone being within range of its paired receiver, or from the teacher's web access screen. The system shall also be capable of approximately locating the location of the alert in the case of a wireless microphone that is not in range of its paired receiver.
16. Upon alert, the system shall:

- a. Have the ability to provide notification on the dedicated console at the front office, or on any other computer which is currently logged into the administrative interface and has the appropriate credentials.
 - b. Provide both an audible tone, and a change on the screen that clearly indicates that an emergency alert has been received.
 - c. Capable of sending e-mail and SMS text messages to designated school personnel. These alerts shall include a web link to the administrative console.
 - d. Acknowledge the receipt of the alert by changing the indicators on the classroom microphone receiver in the room where the alert was received from. In the case of an alert received from a microphone not in range of its paired receiver, no acknowledge shall be sent.
 - e. If cameras are installed in the classrooms, the system shall be capable of showing a live video from the classroom that received an alert. This shall only be shown in the case of an alert where the microphone is within range of its paired receiver.
17. The system shall contain a rules-based integration engine that allows for input of TCP, HTTP, or Serial Data and allows for the parsing of data for actions or triggering other systems via TCP, HTTP or Serial.
 18. The system shall support digital message displays that provide visual feedback in the form of scrolling messages via an LCD or LED display all controlled from the network.
 19. The system shall have the ability to carry IP Communications to the edge of the classroom Audio/visual Systems. It shall be able to control connected A/V Devices, provided that those devices are controllable by RS-232.
- B. Intercom Paging System Administrative Console:
1. The administrative console shall be customizable, flexible and provide full access to the intercom paging system.
 2. Console shall be micro-computer based running a Linux OS and run in a Kiosk mode locking the user into the intercom screen.
 3. The supplier is required to provide a dedicated touch screen console as noted within the drawings, with a minimum size of 22" Diagonally. The Console shall not require the district to provide any additional hardware, software or licensing. The Console shall also provide a boom microphone attached via USB to the console for paging/intercom use.
 4. Administrative access to the system shall be browser based and shall also be capable of being any administrative computer.
 5. Functionality to provide full access to all features such as all call, paging groups, emergency tones, control music, WAV file distribution, test rooms, crisis mode, schedules, etc.
- C. IP addressable Module for non-classroom zones (Audio Enhancement – MS-300):
1. Full Duplex, hands-free communications on intercom call
 2. Amplifier powered only by the PoE power source for emergency paging applications
 3. Mounting bracket as required, refer to drawings for location and mounting requirements identified on plans as follows:
 - a. Individual zones "Z-ID"
 - b. Common zones with "Z-#X#"

4. Connections – The following connections must be available:
 - a. Line-level Output
 - b. Two (2) External I/O Connections – Terminal Block
 - c. RJ45 for PoE Network Connection
 - d. Serial interface for connecting to other equipment or SAFE compatible equipment.
 5. Speaker Connection that is powered exclusively by the PoE power from the network that can drive up to two (2) loudspeakers.
 6. Integrated Network-Based Communications shall support the following protocols:
 - a. Directed UDP
 - b. Unicast Audio
 - c. Multi-Cast Audio
 - d. SIP
 7. The system must have integrated SIP communications and be able to communication bi-directionally with any VoIP communications system that follows the standard SIP protocols.
 8. If zones has two or less loudspeakers the module may be secured above accessible ceiling near the entry door. Contractor is responsible for coordinating with Horizontal cabling installer.
- D. IP-addressable Module for classrooms:
1. Classroom IP addressable modules will be provided as part of specification 27 4100 and included in 27 4100 Contractors scope of work. Intercom contractor shall provide all programming for device. 27 5123 Contractor to coordinate with 27 4100 Contractor prior to device deployment for programming. Refer to specification 27 4100 for additional information on the CSAS.
- E. Volume control/attenuator:
1. Support up to 100 watts in a 70- or 25-volt distribution system.
 2. Mount on a brushed stainless-steel single gang wall plate with the plate being embossed with a dial scale of “0 through 10.” Each number shall be a 3dB step
 3. Provided with a skirted black knob with white position indicator.
- F. Microphone:
1. Decora style mounting wall plate with an Omni-directional electret microphone that has a -44 dB sensitivity
- G. Audio Paging/Program Amplifiers: Stewart Audio – CVA25-1 25V/70V, Atlas Sound – CP400 or equal
1. Power amplifier(s) shall be provided to provide a maximum of 2 watts of power to each loudspeaker on the zone, with the exception to exterior zones provide a minimum of 10 watts to each loudspeaker on the zone.
 2. The maximum load on the paging/program amplifiers shall be 50% of the rated maximum output of the amplifiers.
 3. Provide 25-volt transformer output for all zones that connect more than one (1) loudspeaker together.
- H. Normal/Emergency (2 Button) Call Switch Indicated on plans as ‘CAL’:

1. Call Switches shall provide the following functions and features within a decora style wall plate:
 - a. One (1) "Normal" call switch that shall activate a distinctive "NORM" level call from a single button activation. The button shall be clearly marked "NORMAL" or "CALL".
 - b. One (1) "Emergency" call switch that shall activate a distinctive "EMERGENCY" level call from a single button activation. The button shall be red in color and shall be clearly marked "EMERGENCY".
 - c. Buttons shall route the call-in to any one or more Administrative Telephones or SIP interface for quick and easy response from an Administrative Telephone or off-site telephone.
 - d. Integrated Omni-directional microphone
 2. Connection to the intercom system shall be over Category based cable from the Call Switch to the SIP device/loudspeaker.
- I. Loudspeakers:
1. AtlasIED and Quam loudspeaker assemblies are the basis of design. Intercom manufacturer equivalent loudspeakers are allowed if they meet the function and form of the loudspeakers listed below.
 2. Loudspeaker cabling for common zones shall use a 16 AWG 2-pair stranded conductor cable assembly unless otherwise noted. Refer to Audiovisual Cable and Conduit Schedule on the drawings for approved cabling manufacturer.
 3. Type 'IC1' - loudspeaker assembly (lay-in tile):
 - a. Quam – System 5 or equal
 - b. 1'x2' ceiling tile replacement loudspeaker with 5 oz. magnet and 5 watt 24/70V transformer. 92dB SPL 1W/1M with 99dB max SPL at maximum tap. 65Hz – 17kHz frequency response ± 3 dB and 100-degree dispersion angle.
 - c. Quam – System 12 or equal
 - d. 2'x2' ceiling tile replacement loudspeaker with 5 oz. magnet and 5 watt 24/70V transformer. 92dB SPL 1W/1M with 99dB max SPL at maximum tap. 65Hz – 17kHz frequency response ± 3 dB and 100-degree dispersion angle.
 4. Type 'IC2' - loudspeaker assembly (hard lid ceiling):
 - a. Atlas – SD72W w/ 76-8 mounting ring and BMTT95-8 enclosure
 - b. Quam – C10X/BU/WS w/ SSB-7 mounting ring and ERD-8U enclosure
 - c. Gyp loudspeaker with 10 oz. magnet and 5 watt 24/70V transformer. 95dB SPL 1W/1M with 102dB max SPL at maximum tap. 60Hz – 8kHz frequency response ± 3 dB and 90-degree dispersion angle.
 5. Type 'IC3' - loudspeaker assembly (structurally mounted):
 - a. Atlas – SD72W w/ BMTT95-8 enclosure
 - b. Quam – C10X/BU/WS w/ ERD-8U enclosure
 - c. Open ceiling direct mount to structure loudspeaker with 10 oz. magnet and 5 watt 24/70V transformer. 95dB SPL 1W/1M with 102dB max SPL

- at maximum tap. 60Hz – 8kHz frequency response ± 3 dB and 90-degree dispersion angle.
6. Type 'IC4' - loudspeaker assembly (lay-in tile IP);
 - a. Intercom Manufacturer specific assembly with an IP Addressable module and loudspeaker.
 7. Type 'IW1' - loudspeaker assembly (recessed wall mount interior):
 - a. Quam – 8C5PAX/TBLU w/ ES-8 enclosure and BS8W grill
 - b. Indoor recessed wall 8" loudspeaker with 5 oz. magnet and 5 watt 24/70V transformer. 92dB SPL 1W/1M with 99dB max SPL at maximum tap. 65Hz – 17kHz frequency response ± 3 dB and 100-degree dispersion angle.
 8. Type 'IW2' - loudspeaker assembly (recessed wall mount exterior):
 - a. Atlas – VTF-152UCN or VTF-157UCN w/ AR Adapter Ring
 - b. Exterior recessed wall 4" loudspeaker with 5 watt 24/70V transformer. 96dB SPL 1W/1M with 107dB max SPL at maximum tap. 600Hz – 5.5kHz frequency response ± 5 dB and 170-degree dispersion angle.
 9. Type 'IW3' loudspeaker assembly (exterior hour):
 - a. Atlas – AP-15T
 - b. Exterior Horn with compression driver and 15 watt 24/70/100V transformer. 106dB SPL 1W/1M with 120dB max SPL at maximum tap. 400Hz – 14kHz frequency response ± 5 dB and 70-degree dispersion angle.
- J. UPS – Juice Goose – SCV-20001 or equal
1. Contractor to verify UPS load requirements prior to purchase of UPS. Intercom system shall maintain power for 30 minutes after building loses power.
- K. Clocks:
1. Clocks shall be battery powered. The contractor shall provide a fresh battery and install each clock set to the correct local time. Room types will have different size requirements.
 2. 12" clock – American Time and signal – E56BAQD304BF
 - a. Provide 1 clock per the following room types:
 - i. Learning Studio/Classrooms
 - ii. Collaboration Area
 - iii. Offices
 - iv. Work rooms
 - v. Conference rooms
 3. 15" clock – American Time and signal – E66BAQD304BF (Recreational Space Clock)
 - a. Provide 1 clock per the following room types:
 - i. Gymnasiums (provide 1 on each side of the dividing curtain)
 - ii. Music rooms
 - iii. Shops
 - iv. Kitchen

- v. Commons/learning stairs
 - vi. Media center
4. Provide wire guard on all clocks in locations where other devices are protected. Coordinate with fire alarm plans for locations requiring wire guards.

2.3 INTERCOMMUNICATION, PROGRAM DISTRIBUTION, CLOCK/TIME SIGNALING SYSTEM

1. Separately addressable paging zones shall be provided as indicated on the drawings. Zones shall be capable of being grouped for various call scenarios as defined or requested by the owner.
2. Refer to the intercom drawings for identification of zones, zone types, and ceiling construction type.
 - a. Individual zones are designated with “Z-ID”
 - b. Common distributed zones are identified with a unique zone number “Z-#X#”.
3. Space requirements:
 - a. Classrooms/Teaching spaces.
 - i. The IP module/loudspeakers for each space shall be utilized for the intercommunication system.
 - ii. One (1) Call switch shall be provided in each room near the CSA antenna location. Refer to drawings for location of devices.
 - iii. One (1) Clock located above the entrance door.
 - b. Shared spaces between Classrooms/Teaching spaces.
 - i. The IP module/loudspeakers for each space shall be utilized for the intercommunication system.
 - ii. One (1) Call switch shall be provided on the wall adjacent to the main hallway.
 - iii. One (1) Clock located above the entrance door.
 - iv. These rooms will be used as shelter in place rooms for adjoining classrooms.
 - c. Specialty Teaching spaces with high ambient noise floor (Wood/Metal/AG shops).
 - i. Distributed ceiling recessed loudspeakers (Qty. as required) at 14' by 14' minimum spacing, type as required for ceiling construction.
 - ii. Visual strobe
 - iii. One (1) Call switch shall be provided at the primary teaching station. Coordinate location of primary teaching location with drawings.
 - iv. One (1) Clock located above the entrance door
 - d. Private Offices, Conference rooms, Faculty Lounges & Work Rooms (outside of the main office/administration suite)
 - i. One (1) ceiling mounted loudspeaker, type as required for ceiling construction.
 - ii. Connect to adjacent corridor zone you enter the office from
 - iii. Offices off of a classroom shall be on the same zone as the classroom

- iv. Gymnasium
- e. Gymnasium
 - i. Ceiling mounted loudspeakers, Qty. and type as required for ceiling construction and adequate coverage (< 6dB level variation).
 - ii. One (1) Call switch shall be provided co-located with any light switches adjacent to each entrance.
- f. Cafeteria/Commons/Dining
 - i. Ceiling mounted loudspeakers, Qty. and type as required for ceiling construction and adequate coverage (< 6dB level variation).
- g. Kitchen
 - i. Ceiling mounted loudspeakers, Qty. and type as required for ceiling construction and adequate coverage (< 6dB level variation).
 - ii. One (1) Call switch shall be provided co-located with any light switches adjacent to main entrance.
 - iii. Within the Kitchen office provide a two-way system with call button and loudspeaker.
- h. Corridors, Vestibules & Open Collaboration/Circulation areas
 - i. Distributed ceiling recessed loudspeakers (Qty. as required) at 20' minimum spacing, type as required for ceiling construction.
 - ii. Rooms that are wider than 25' shall require an additional row of loudspeakers and located on a maximum of a 20' x 20' spacing centered in the room.
 - iii. Coordinate with ceiling devices and locate adjacent to smoke detectors when within few feet of one. Loudspeakers shall be in line with any lighting within the space
 - iv. Provide a minimum of one (1) loudspeaker for each space type
- i. Stairwells
 - i. One (1) ceiling mounted loudspeaker, type as required for ceiling construction.
 - ii. Connect to the adjacent corridor zone.
- j. Restrooms
 - i. One (1) ceiling mounted loudspeaker, type as required for ceiling construction.
 - ii. Connect to the adjacent corridor zone
 - iii. Do not provide loudspeakers in single use restrooms adjacent to a corridor zone.
- k. Administration Suite (Private offices, Conference rooms, Nurse areas, work rooms, reception, etc. within the main administration suite)
 - i. Distributed ceiling recessed loudspeakers (Qty. as required) at 20' minimum spacing down corridors and 14' x 14' in open areas, type as required for ceiling construction.
 - ii. Provide a minimum of one (1) loudspeaker for each space type.

- iii. Provide a minimum of one (1) loudspeaker on an individual zone in the reception area. General pages from the reception area shall not play over this zone, it shall only be used for prerecorded messages.
 - I. Building Exterior
 - i. Distributed recessed loudspeakers (Qty. as required) to cover all sides of the building and all entrances.
 - ii. Coordinate and co-locate loudspeaker rough-in with exterior fire alarm horn strobe locations.
 - iii. Provide unique zone for each side of the building (North/South/East/West)
 - iv. Provide 'IW3' type loudspeakers on areas with:
 - 1. Playground equipment
 - 2. Fields
 - 3. Other play surfaces
 - v. Provide 'IW2' type loudspeakers on the front of the building and in locations where the property line is less than 30' from the building.
 - m. Rooms smaller than 100 sqft and that are adjacent to a corridor/hallway will not require a loudspeaker when an announcement is audible within the room. Audible within the room shall be defined as 15 dB above the ambient noise within the room.
 - i. Vestibules are excluded from small rooms and will require a loudspeaker tied to the adjacent corridor zone.
- B. All class-change bell signaling shall be sounded over the intercommunication system.
- 1. Each dialing administrative console in the system shall be programmable for the following options:
 - a. Allow zone paging.
 - b. Allow All-Page announcements.
 - c. Allow Executive Override.
 - d. Allow Emergency paging.
 - e. Allow activation of Time Zone tones.
 - f. Set the priority level and target display of "normal" calls.
 - g. Set the priority level and target display of "emergency" calls.
 - h. Assignment of architectural number.
 - i. Class of Service.
 - j. Assignment of associated speaker to paging zone.
 - k. Automatic Call-Back-Busy.
 - l. Call Forward-No Answer.
 - m. Call Forward-Busy.
 - n. Allow activation of security monitoring functions on a per room and per zone basis.

- C. All class-change signaling shall be sounded over system loudspeakers as programmed.

PART 3 - EXECUTION

3.1 GENERAL

- A. Wiring shall be installed in metallic conduit and provided with necessary junction and pull boxes. All wiring shall be color coded and in accordance with the manufacturer's instructions, local and national codes. Care shall be exercised in wiring to avoid damage to the cables. All boxes shall be plumb and square. Cables shall be pulled continuous without splicing, leaving ends in lengths as directed by the manufacturer's representative.
- B. After all circuits and cables have been pulled and completed from one extremity to the other, the electrical contractor shall check all circuits free of opens, shorts and grounds. The electrical contractor shall identify and tag all cables at the head end.
- C. The manufacturer's representative shall make all final connections to the equipment, shall test and adjust the systems, and shall instruct the proper parties as to care and operation.
- D. Any additional equipment required for a fully functional system to meet the intent of the specifications shall be provided whether or not specifically listed herein.

3.2 INSTALLATION OF SOUND SYSTEMS:

- A. Install sound systems as indicated, in accordance with equipment manufacturer's instructions, and with recognized industry practices, to ensure that system equipment complies with requirements. Comply with requirements of NEC and applicable portions of NECA's "Standard of Installation" practices.
- B. Equalize systems using industry recognized practices and equipment.
- C. Pathway Requirements:
1. General:
 - a. All pathways shall be designed, constructed, grounded and installed in accordance with all recommendations delineated within TIA 569-B and Standard TIA 942.
 - b. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. Arrangements to remove any major obstructions not identified on plans need to be determined at that time with the Engineer.
 2. Conduits:
 - a. Contractor shall provide a minimum of 1-1" EMT conduit from device to cable tray, unless otherwise noted, for device connections exiting the room. Refer to symbol schedule for specific conduit requirements.
 - b. Achieve the best direct route parallel with building lines with no single bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.
 - c. Provide large radius elbows on all bends.
 - d. Conduit runs shall not have continuous sections longer than 100 feet without a pull box. Refer to rough-in schedule for conduit fill capacity.
 - e. AV conduits should not be routed over or adjacent to heat sources such as boilers, hot water lines, or steam lines. Neither should they be routed

- near large motors, generators, photocopy equipment, or electrical power cabling and transformers.
- f. After installation, conduits shall be clean, dry, unobstructed, capped for protection, labeled for identification, reamed and fitted with bushings.
 - g. A 200lb pull cord (nylon, 1/8" minimum) shall be installed in any empty conduit.
3. Open Top Cable Support Requirements:
- a. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables
 - b. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
4. Pull Box Requirements:
- a. NEC sized pull boxes are not acceptable. Follow BICSI and EIA/TIA 569-B guidelines for pull box sizing.
 - b. Provide pull boxes in sections of conduit that are 100 feet or longer, contain more than two 90 degree bends, or contain a reverse bend.
 - c. Conduits that enter a pull box from opposite ends should be aligned.
 - d. Pull boxes shall have a length 12 times the diameter of the largest conduit.
 - e. All pull boxes must be accessible.
- D. Cabling System:
1. Follow T568B scheme for copper category cabling terminations.
 2. Provide a minimum 6" service loop in each AV system junction box. Cables shall be coiled in the in-wall boxes if adequate space is present to house the cable coil without exceeding manufacturers bend radius.
 3. In a false ceiling environment, a minimum of 3 inches shall be maintained between cable supports and false ceiling. At no point shall cable(s) rest on lay-in ceiling grids or panels.
 4. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
 5. Cables shall not be attached to ceiling grid seismic support wires or lighting fixture seismic support wires. Where support for AV cable is required, the contractor shall install appropriate carriers to support the cabling.
 6. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
 7. Pulling tension for balanced twisted pair shall not exceed 25lbf and for optical fiber shall not exceed 50lbf.
 8. Pair untwist at the termination shall not exceed 0.125". The cable jacket shall be maintained as close as possible to the termination point.
 9. Cable shall not be draped on, tied or otherwise secured to electrical conduit,

plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.

- E. Cabling groups and conduit separation:
 - 1. Refer to “CABLING GROUPS AND CONDUIT SEPARATION SCHEDULE”.
- F. Firmly secure all equipment in place that is not intended for portability.
- G. Mount projectors permanently and provide mechanical index ensuring precise alignment of the projected image.
- H. Provide adequate structural support for AV system components. Provide fastenings and supports with a safety load factor of at least five.

3.3 GROUNDING:

- A. All grounding and bonding shall be done according to ANSI J-STD-607-A, TIA 942, and NEC.
- B. All cabinets/racks shall utilize paint piercing grounding washers, to be used where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack.
- C. All racks shall further utilize a full-length rack ground strip attached to the rear of the side rail with the thread-forming screws provided to ensure metal-to-metal contact. Similar to Panduit RGS.
- D. All active equipment shall be bonded to ground. If the equipment manufacturer provides a location for mounting a grounding connection, that connection shall be utilized. All active equipment shall be bonded using the appropriate jumper for the equipment being installed using the thread-forming screws. Similar to Panduit RG.
- E. Racks shall have individual, appropriately sized conductors bonded to the grounding backbone. Do not bond racks or cabinets serially – daisy-chained rack grounds will not be accepted.
- F. Refer to electrical diagrams for additional ground connection requirements.

3.4 LABELING

- A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and wall plates. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
- B. All labels shall meet UL 969 requirements for legibility, defacement and adhesion requirements. Handwritten, Ink, or Laser Printing labels are not allowed. Labels shall be uniform in physical size and text height with minimal blank space. Provide labels using thermal transfer print. Heat shrinking or wraparound labels are required, flag style labels are not allowed.
- C. Provide laminated plans (minimum size 11x17) of all Intercom as-built plans (including

riser diagrams) intercom rack. Contractor shall be responsible for providing a 1RU drawer.

- D. Label each equipment with the date (month/year) that it was installed along with the IP address, if applicable, and equipment type.

3.5 CYBER SECURITY

- A. Contractor shall change all default username and passwords for all network devices provided. A Strong Password should include at a minimum the following:
 - 1. Be at least 12 characters in length
 - 2. Contain both upper and lowercase alphabetic characters (e.g. A-Z, a-z)
 - 3. Have at least one numerical character (e.g. 0-9)
 - 4. Have at least one special character (e.g. ~!@#\$\$%^&*()_-=)
 - 5. Cannot contain full words
- B. No written username or passwords shall be located in any areas of installation.
- C. Network devices to be set up on a separate network other than owner's LAN ensuring no internal or external users can access system without authorization.
- D. Follow manufacturers hardening guide and use best industry practices to secure network and devices provided by contractor and associated with system.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services:
 - 1. Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Inspection:
 - 1. Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.
 - 2. The installation technician from the installer / manufacturer shall perform all system tests as specified. Perform all tests in the presence of the Owner, Architect / Engineer and any designated personnel as deemed necessary by the Owner or Architect / Engineer. This test shall be performed with the devices at their operational location and under normal operational conditions. Bench or default settings for devices are not acceptable. All test and test report costs shall be included in the contractors bid. A checkout report shall be generated by the installation technician and submitted to the Owner and Architect. The report shall include but not be limited to the following:

- a. A complete list of all equipment installed with corresponding serial numbers.
- b. Indication that all equipment is properly installed, functions and conforms to the specifications.
- c. Serial numbers, locations by device and model number for each installed device.
- d. Technician's name, specified certification credentials and date of system test.
- e. Any additional information as deemed necessary by the Owner and or Architect / Engineer.

C. TESTING:

1. Upon completion of installation of each system and after electrical circuitry has been energized, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units on site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with testing.
2. Before inspection by owner and AV Consultant, and after completion of the installation, conduct system tests and make necessary corrections for proper system operation.
3. Adjust, balance and align equipment for optimum quality and to meet the manufacturer's published specifications.
4. All limiters and/or compressors shall be set to prevent operators from over-adjusting sound levels and damaging system components.
5. System shall have no audible hum, noise, RFI, or distortion when operating under normal conditions. System shall reproduce material at the loudspeakers rated output level without audible distortion. All input levels shall be pre-set so system may be operated without causing unstable feedback under normal use.
6. System shall have no image distortion, hum bars, color shift, or any other picture distortion while operating under normal conditions. Provide cable equalizers, located near displays, on all cables that are more than 30 feet in length and/or have more than 4 connection points.
7. Adjust gain controls for optimum signal-to-noise with 0 dBu at a line-level input.
8. Perform polarity checks of loudspeaker lines by means of a polarity tester or use DC source at one end of each line and a voltmeter at the other end. Loudspeaker lines shall be identically polarized with respect to color coding.
9. Loose parts and poor workmanship or soldering shall be replaced.
10. Sweep Loudspeaker systems with high-level sine wave or 1/3 octave pink noise source. Correct causes of buzzes or rattles related to Loudspeakers or enclosures. Notify owner of external causes of buzzes or rattles.
11. Contractor shall provide system testing as described herein using up-to-date and industry accepted test equipment appropriate to the types of links being tested and in accordance with the latest edition of IEC 61935-1.
12. Horizontal cabling contractor shall test all twisted pair cabling used within the system following the standards in specification 27 1500 under the testing section.

Provide documentation of testing to Intercom Consultant prior to final walk through.

- D. At the time of final commissioning, if the Intercom consultant determines that the systems are not sufficiently complete to do a final punch list, and was not notified at least three (3) days prior to the visit, then a return visit will be required. The Intercom Consultant's return visit will be paid for in advance by the Intercom integrator at a flat rate of \$500 per person, at no cost to the owner.

3.7 OCCUPANCY ADJUSTMENTS:

- A. When requested by the Architect within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions.

3.8 TRAINING

- A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions.
- B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.
- C. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all of the staff and faculty members who attended, received and completed the training program.
- D. Provide a minimum of four (4) six (6) hour sessions of in-service training with this system. These sessions shall be broken into segments that will facilitate the training of individuals in the operation of this system. Operators Manuals and Users Guides shall be provided at the time of this training.
- E. Schedule training with Owner through the Architect, with at least fourteen (14) days advance notice.
- F. Training shall be recorded using a video recording device that support a minimum resolution of 1080P/60 with an integrated microphone connection for an external microphone and a camera tri-pod mount. Presenter shall be wearing a lapel microphone that connects to the recording device and a Tri-pod shall be used for stabilizing the recording device. Recordings that are shaky, poor audio and/or video quality, incomplete, or other issues will not be accepted and the contractor will be responsible for providing a new recording and training within five (5) business days of notification. Provide a digital copy to the Owner and Intercom Consultant. If Digital copy is sent in a link, verification of end user download shall be provided to the owner and Intercom Consultant showing IP address or user that download and what date. The link cannot have an expiration date and will be the responsibility of the contractor to maintain. Links shall be included in the Operating and Maintenance manuals in the first section. Video files shall also be provided on a flash drive within the intercom equipment rack adjacent to the server location. Flash drive shall be clearly labeled.

3.9 CLEANING AND PROTECTION

- A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up.

3.10 OPERATING AND MAINTENANCE MANUALS: Refer to Section 26 0502 for requirements.

END OF SECTION 27 5123

SECTION 28 0501 - COMMON REQUIREMENTS FOR INTRUSION, ACCESS CONTROLS, & VIDEO SURVEILLANCE SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Architectural, Structural, Mechanical, Electrical and other applicable documents are considered a part of the security documents insofar as they apply as if referred to in full. Contractors must review the entire set of plans and specifications. Reviewing only the security set is not acceptable.
- C. Division 26, 27 & 28 basic materials and methods sections apply to work specified in this section, including but not limited to for requirements for raceways, trays, boxes, and fittings, and supporting devices, and other sections, as applicable.
- D. Refer to specification 26 0553 Electrical Identification for cabling, conduit, and junction box color requirements.
- E. Refer to specification 27 1500 Telephone Data Systems for category and/or optical fiber cable, connectivity specifications, additional pathway requirements, and installation standards.
- F. This specification does not address other Division 28 sections, such as the Nurse Call System and/or Fire Alarm and Detection Systems.

1.2 ENGINEER CONTACT INFORMATION:

- A. BNA Security Contact(s):
 - 1. Jerry Burnside
Phone: 801-532-2196
Email: Jerry@BNAConsulting.com
 - 2. Dan Varney
Phone: 801-532-2196
Email: DVarney@BNAConsulting.com

1.3 DESCRIPTION OF WORK:

- A. Security work is defined as any Division 28 system specified, including but not limited to intrusion detection system, access control system, and IP video surveillance system.
- B. The extent of security work is indicated on drawings and/or specified in Divisions 26, 27 and 28 sections of the specification. Provide all labor, materials, equipment, supervision, and service necessary for complete and working systems.
- C. Provide the specified systems in a complete and operating condition with all necessary materials and labor to fulfill the requirements and the intent of the drawings and specifications. Except as otherwise indicated, provide manufacturer's standard system components. Contractor shall provide all cables, materials, and equipment, whether specifically mentioned herein or not, to ensure a complete and functional system.
- D. The installation contractors are responsible for coordinating with all other trades for equipment locations, mounting requirements, supports, and plenum space requirements. Contractor shall provide plenum rated cabling if required per the mechanical drawings.

- E. Contractor shall provide ¾" EMT conduit from devices to accessible ceiling space, then utilize non-continuous cable support devices (J-Hooks) to head-end equipment, utilizing cable tray if on project.
- F. All security systems installed shall allow seamless integration and operate with one another (Intrusion Detection - Access Control – IP Video Surveillance).
- G. All raceways and enclosures shall be securely fastened and/or mounted as per the currently adopted version of the National Electrical Code (NFPA 70). All work must be completed in a neat and workmanlike manner.

1.4 BID SUBMITTAL:

- A. Provide a detailed scope of work document for all services provided.
- B. Provide a complete bill of materials for all components, accessories, and hardware to be provided to assemble a complete and fully functional system as described within the contract documents.
- C. Provide a breakout cost of material and labor as different line items. Bids must include line-item pricing for major parts and components of the system.
- D. Submit manufacturer certifications for all systems provided. Certifications must be from the local office providing the installation.
- E. All permitting costs shall be included in base bid.
- F. All equipment shall be installed as shown on the drawings and in strict accordance with the specifications. Any errors, conflicts, or omissions discovered in the specifications, or drawings, shall be submitted in writing to the Security Consultant for clarification in an RFI prior to bid.

1.5 QUALITY ASSURANCE:

- A. MANUFACTURERS: Firms regularly engaged in the manufacture of security system equipment and components of the types described here in and whose products have been in satisfactory use in similar applications for not less than five years.
- B. Integrating firm shall have worked satisfactorily for a minimum of five years of completing systems equal to this scope, quality, type, and complexity.
 - 1. Key personnel assigned to the project shall each have a minimum of five years of experience in completing systems equal to this scope, quality, type, and complexity.
 - 2. Contractor shall be a factory authorized installer of all equipment specified for the geographical area of the project.
 - 3. Contractor shall maintain complete installation and service facilities for the duration of the project contract.
 - 4. Contractor shall have current manufacturer certifications for all security systems and equipment listed within this specification. Certifications must be from local office providing the installation.
- C. All work shall be done by expert technicians qualified in the field with knowledge of specified systems. Workmanship shall comply with industry best practices concerning grounding, shielding, cable dressing, cable termination and equipment mounting.
- D. All technicians are required to have proper state licensing to perform work within this specification.
- E. List of qualifications include:
 - 1. Industries certifications including manufacturers.

2. Past and current projects within the last five years are similar in scope and size.
3. Provide three different referrals from the owners of three different projects within the last five years.

1.6 GENERAL COORDINATION:

- A. Meet with Electrical Contractor prior to pathway rough-in to coordinate system requirements in each area and review each security device that requires 120V power.
- B. Meet with Owner's IT Department prior to ordering equipment to coordinate IT services to equipment.
- C. Meet with Low Voltage Cabling Contractor (Division 27 1500) at least once, prior to rough-in, to verify all category cabling needs to equipment.
- D. Regular inspections are required and shall be scheduled by the contractor through the Owner/Architect at least twenty-four hours in advance.
- E. Coordinate color and finish of all components with Architect.
- F. Notify engineer of any modifications between contract documents and submittals. It is the contractor's responsibility to ensure compliance with the documents.
- G. Contractor's Project Manager will be required to schedule and provide weekly updates via remote meeting and/or email communications on progress of installation and update project schedule if any dates change from original completion.

1.7 SUBMITTALS:

- A. Refer to specification 26 0502 "Electrical Submittals and Spare Parts" for submittal requirements.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Provide complete raceway system for security system including but not limited to, raceway, outlets, cover plates, backboards, cabinets, grounding and miscellaneous items as required.
- B. Provide plywood terminal backboards, 4' x 8' x $\frac{3}{4}$ " unless otherwise noted for all security equipment unless otherwise noted to be installed in racks.

PART 3 – EXECUTION:

3.1 GENERAL REQUIREMENTS

- A. Provide and install proper finger wire duct with covers within each panel per project requirements. Provide and install Velcro to neatly bundle cables. All cabling shall be installed in a neat and workmanlike manner.
- B. Install systems as indicated, in accordance with equipment manufacturers' written instructions, and with recognized industry practices, to ensure that system equipment complies with requirements. Comply with NEC requirements and applicable portions of NECA's "Standards of Installation" practices.
- C. Coordinate all equipment locations and mounting details with other trades and suppliers.
- D. Provide at least one duplex receptacle on dedicated power circuit next to specified panels.
- E. Grounding: Provide grounding connections sufficiently tight to assure permanent and

effective ground.

- F. Conceal raceways and conduits unless otherwise noted in specifications and drawings. Where exposed raceways are permitted, run parallel/perpendicular to walls.

PART 4 – TESTING:

4.1 GENERAL REQUIREMENTS:

- A. Testing: Upon completion of installation of system and after energized, demonstrate system compliance with intent.
- B. Coordinate a final inspection of the security systems installed with the security consultant three weeks in advance of finishing.

PART 5 – LABELING & TRAINING

5.1 GENERAL REQUIREMENTS:

- A. The contractor shall develop and submit for approval a labeling system for the device and cable installation. Coordinate with the owner and negotiate an appropriate labeling scheme with the contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels, and wall plates. The labeling system shall designate the cables' origin and destination and a unique identifier for the cable within the system. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
- B. All labels shall meet UL 969 requirements for legibility, defacement, and adhesion requirements. Handwritten labels are not allowed. All labels shall maintain consistent typeface, size, and color.

5.2 TRAINING:

- A. Provide four sessions of two hours each of training on the operation of each system, at job site, at no cost to owner. Systems shall be complete and have been finalized by the Consultant prior to training.
- B. The security contractor will terminate, program and test each system and all of the equipment. As built drawing package (refer to specification 26 0502 "Electrical Submittals and Spare Parts" for as-built drawing package requirements) shall be provided to the school district before commissioning shall begin. System loops will be tested, and any fault conditions found shall be corrected immediately by the contractor.

5.3 CYBERSECURITY

- A. Contractor shall change all default usernames and passwords for all network devices provided. A Strong Password should -
 - 1. Be at least 8 characters in length.
 - 2. Contain both upper and lowercase alphabetic characters (e.g., A-Z, a-z)
 - 3. Have at least one numerical character (e.g., 0-9)
 - 4. Have at least one special character (e.g., ~! @\$%^&*()_-=)
- B. No written username or passwords shall be located in any areas of installation, except in the O&M manual.
- C. Network devices to be set up on a separate network other than owner's LAN ensuring no internal or external users can access system without authorization. Follow manufacturers hardening guide and use best industry practices to secure network and devices provided by contractor and associated with system.

5.4 WARRANTY AND SERVICE:

- A. The minimum warranty period shall be one year, the warranty period will begin when the system completion documents are submitted to the owners and the system has successfully passed all tests and inspections. Included in the completion documents will be a warranty and service contact form, this form will be filled out by the burglar alarm contractor, all necessary contact information shall be included to guarantee a response to the system site within 24 HOURS OF THE REQUEST FOR SYSTEM SERVICE. Only qualified technicians capable of making needed repairs and/or system programming are accepted to respond for service.
- B. Contractor shall honor equipment warranties for term established by manufacturer if greater than warranty time frame mentioned above.
- C. During warranty time period:
 - 1. Systems designed for 24/7 operation shall be repaired and/or replaced within 24 hours of time of notification. If defective components cannot be repaired in time, provide temporary equipment as required.
 - 2. During the warranty time period, upon owner request, the contractor shall provide programming changes up to four times or four hours free of charge.

END OF SECTION 28 0501

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SECTION 28 1600

INTRUSION DETECTION SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26, 27 & 28 basic materials and methods sections apply to work specified in this section.
- C. Division 28 0501 Common Work Results for Electronic Safety & Security, apply to this section.

1.2 DESCRIPTION OF WORK:

- A. Provide a complete and operational Intrusion Detection System that will communicate to a certified central monitoring/reporting station; with all necessary material and labor to fulfill the requirement and the intent of the drawing and specifications. Any requirements not understood, or proposed deviances from these installation guidelines should be directed to and approved by the owner. Changes, adjustments, or deviations from this standard by the contractor that are not approved in writing by the owner are the sole responsibility of the contractor and may be ordered corrected at any time before or after completion of the job.
- B. The intrusion detection system work is indicated by drawings and is hereby defined to include, but not be limited to, head-end control panel, back-up batteries, power supplies, cabling, keypads, motion detector, door/window contacts, outlets, cover plates, backboards, grounding, and all miscellaneous items required for complete system.
- C. Monitoring service is not included in the scope of work.

1.3 QUALITY ASSURANCE (INTRUSION DETECTION SYSTEM SPECIFIC):

- A. Pre-Approved Installation Contractor:
 - 1. Nelson Fire Systems

PART 2 – WIRING

2.1 WIRING SPECIFICATIONS:

- A. The security cable outer jacketing shall be gray, plenum rated, UL listed, and pre-approved by the school district.
- B. All system wiring (except line voltage and telephone connections) shall be minimum 18 gauge, stranded, plenum rated, copper cable, unless otherwise noted.
- C. Telephone connections shall be a specified CAT6 category cable, plenum rated, that connects to the panel telephone line connection terminals via an RJ31X telephone jack and cord. Direct wiring of telephone lines to panel circuit board is not acceptable.

2.2 WIRE TYPES:

- A. WIRING: Provide the following wiring for the security system components:
 - 1. Keypad / Duress / Panic / Hold-Up Buttons:
 - i. 22-gauge 4-conductor, stranded, plenum rated cable.

2. Door / Window / Garage / Roof Hatch Contacts:
 - i. 22-gauge 2-conductor, stranded, plenum rated cable.
3. Motion Detector, Glass Break, Smoke / Heat / CO Detector:
 - i. 18-gauge 4-conductor, stranded, plenum rated cable.
4. Siren / Strobe:
 - i. 18-gauge 2-conductor, stranded, plenum rated cable.

PART 3 – EXECUTION:

3.1 AUTHORIZED INTRUSION DETECTION SYSTEM MANUFACTURES:

A. BOSCH

1. Bosch Integrated Control Panel: B9512G-C Kit
2. Bosch Rechargeable Back-Up Battery: D1218
3. Bosch Auxiliary Power Supply Kit: B520-C Kit
4. Bosch POPIT Module: D9127U
5. Bosch POPEX Expansion Module: B299
6. Bosch Alpha Numeric Keypad: B930
7. Bosch Recessed Door Position Contact: ISN-CSD80
8. Bosch Track Mounted Garage Door Contact: ISN-C66
9. Bosch Surface Mounted Roof Hatch Contact: ISN-CMET-200AR
10. Bosch 360° Ceiling Mounted Motion Detector: DS936
11. Amseco Exterior Audible Siren: SSX-52 Series

3.2 MOTION DETECTORS:

- A. Each motion detector shall be independently zoned and device wiring shall be home run to the head-end control panel or zone expander.
- B. Loop supervision resistors shall be installed inside the motion detector. Motion detectors shall be wired to monitor for device trouble and tamper when so equipped.
- C. Mount security devices a minimum of 3 feet from any heat or air movement sources.

3.3 DOOR, WINDOW, GARAGE, ROOF HATCH AND SPECIALIZED CONTACTS:

- A. Match the contact to the door frame color as close as possible.
- B. Loop supervision resistors are to be installed as close to the door contact as possible. All door contacts shall be independently zoned and device wiring shall be home run to the head-end control panel or zone expander location.
- C. For splicing cables together, the preferred way is via soldering. If soldering is not an option utilize B-type silicone wire connectors.

3.4 HOLD-UP, DURESS/PANIC BUTTONS:

- A. Accepted Manufacturers: Bosch, Honeywell, Sentrol, Alarm Controls, & Potter.
- B. Hold-Up, Duress, or Panic type signals will neither be audible nor visible but will send a silent signal to the central monitoring station of the emergency.
- C. Prior to starting any work coordinate with the owner and the millwork drawings for the exact button mounting locations.

3.5 SIREN SOUNDERS AND/OR STROBES:

- A. Accepted Manufacturers: Amseco #SSX-52 Series.

3.6 RECHARGEABLE BACK-UP BATTERIES:

- A. Accepted Manufactures: Bosch, Yuasa, PowerSonic, and Elk brand.
- B. The minimum standby capacity shall be 24 hours.

3.7 HEAD-END PANEL PLUG-IN TRANSFORMER:

- A. Provide one duplex outlet near the head-end control panel for the plug-in transformer. Transformer shall connect to outlet using the anchoring screw that is provided with the transformer.

PART 4 – INSTALLATION REQUIREMENTS:

4.1 CONTROL AND AUXILIARY EQUIPMENT:

- A. Install the intrusion detection security system to the manufacturer's specifications and instructions. Utilize recognized industry practices, to ensure that the system and the equipment comply with the requirements. Comply with the requirements of NEC and applicable portions of NECA's "Standards of Installation" practices.
- B. Coordinate all equipment locations and mounting details with other trades and suppliers.
- C. System enclosures shall be surface mounted no higher than 72" AFF to the top off enclosure and installed only after all wallboard and painting work is complete. All wiring shall enter system enclosures through minimum 1 ¼" nipple located on the top far right-hand side of the enclosure. Plastic bushings are required on all nipples.
- D. Power: Next to the head-end intrusion detection panel, provide one duplex power receptacle that is on a dedicated emergency powered circuit.
- E. Mounting: Prior to starting any work coordinate a meeting with the school district and verify each end device location and their mounting heights.
- F. Mount security devices a minimum of 3 feet from heat or air movement sources.
- G. Grounding: Provide grounding connections sufficiently tight to assure permanent and effective ground.

END OF SECTION 28 1600

SECTION 28 2205

ACCESS CONTROL SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Refer to Division 8 for the door hardware schedule and requirements.
- C. Division-26, 27 & 28 basic materials and methods sections apply to work specified in this section.
- D. Division 28 0501 Common Work Results for Electronic Safety & Security, apply to this section.

1.2 DESCRIPTION OF WORK:

- A. Provide a complete and operating access control system as indicated in the drawings and specifications, and is hereby defined to include, but not be limited to: access control server, control panels, controller boards, protective enclosures, power supplies, credential card readers, raceway, outlets, cover plates, jacks, backboards, cabinets, grounding, video surveillance integration, intrusion detection integration, intercom integration, and all required wiring/cabbling.
- B. The access control installation contractor shall provide all of the required wiring/cabbling, materials, and equipment, whether specifically mentioned herein or not, to ensure a complete and a fully functional system is provided.
- C. The access control installation contractor shall provide all of the necessary materials and labor to fulfill all the requirements and the intent of the drawings and specifications. Except as otherwise indicated, provide manufacturer's standard system components.
- D. The access control installation contractor is responsible for coordinating with the Division 8 door hardware contractor to review the door hardware specification and ensure all components requiring a connection are installed.
- E. Program the access control system that upon activation of an emergency lockdown, or preventative lockdown, a command from the administrative console, web browser, or app a communication protocol will be sent for all, or partial controlled doors, to be locked / unlocked.
- F. Equipment lists are provided to set equipment expectations and may not be complete. Coordinate with devices shown on drawings for system intent. Provide a complete and functional system as described within the construction documents.

1.3 COORDINATION (ACCESS CONTROL SPECIFIC):

- A. It is the access control installation contractor responsibility to coordinate a meeting with architect, the owner, the Division 8 contractor, and the Division 26 electrical contractor PRIOR to starting any work and review the exact locations and rough-in for all end devices and the programming for each door's functionality. Carefully review Division 8 package (including the door hardware schedule and specifications) prior to bid and include all components requiring a connection by Division 26 and 28. Meet with Division 8 post-bid and prior to purchase of any equipment. It is not the Security Engineer's responsibility to complete the coordination between Division 8 and Division 26 and 28 for exact locations, connections, and rough-in.

- B. All door hardware specified shall be reviewed upon award of the bid and before ordering any equipment.
- C. During construction, each location showing equipment shall be walked by the contractor and any discrepancies on door hardware fit, finish, and function shall be brought to the architect and security engineer's attention immediately. It is the contractor's responsibility to provide a complete and functioning system and door opening.
- D. Division 26, 27, and 28 contractors shall verify electrical service provided prior to ordering any electrical equipment serving electronic door hardware equipment and has the final responsibility for properly coordinating the electrical work, including the exact location of the electrical connection(s).
- E. Obtain submittals of all door hardware equipment from door hardware specification and Division 8 and 28 contractors. Carefully review the door hardware submittal and advise in writing of any discrepancies.
- F. The contractor shall include necessary wiring and programming for fire-alarm panel tie-in and door release. Contractor is responsible to schedule and coordinate with the fire alarm contractor. It is the responsibility of the Contractor to review the Division 8 package (specifications and door hardware schedule) to confirm which doors require fire alarm release.
- G. Coordinate all interfaces between door hardware and electrical contractor, including any additional panel interface modules and licensing to provide interface between PoE/wireless electronic locks.
- H. Provide a dedicated 20-amp circuit for access control panel equipment.

1.4 QUALITY ASSURANCE:

- A. Authorized Access Control System Manufacturer:
 - 1. Lenel / OnGuard
- B. Bidders not pre-approved: See Division 28 0501 Part 1.5.

PART 2 – PRODUCTS

2.1 GENERAL REQUIRMENTS:

- A. Provide a complete and operable Open access control system that meets the owner's requirements, operates to the manufacturer specifications, and maintains building security.
- B. The network appliance shall be able to run on an existing TCP/IP network and accessible, configurable, and manageable from any network-connected PC with a browser and/or client.

2.2 GENERAL EQUIPMENT REQUIREMENTS:

- A. Provide all necessary equipment to ensure a complete access control system is achieved. Provide the following equipment as a baseline for the access control system:
 - 1. Access Control Head-End Equipment and Panels

Description	Manufacturer	Part Number
Access Control Server		Per manufacturer
Intelligent Dual Reader Controller Board	Lenel / S2	LNL-2220
Dual Reader Interface Module Board	Lenel / S2	LNL-1320 Series 3
Single Readers Interface Module Board	Lenel / S2	LNL-1300
Input Control Module Board	Lenel / S2	LNL-1100
Output Control Module Board	Lenel / S2	LNL-1200

Power Supply & ACS Enclosure Rechargeable Back-Up Batteries	Altronix or LifeSafety Power Yuasa, PowerSonic, Elk	8Ah 12VDC
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2. End Devices

Credential Card Reader (Wall)	HID Global	Signo 40 - 40NKS-02-000000
Credential Card Reader (Mullion)	HID Global	Signo 20 - 20NKS-02-000000
Request to Exit Motion	Bosch	DS160 (or equivalent)
Request to Exit Trim Plate	Bosch	TS160 (if applicable)
Pneumatic Push to Exit Button	STI	UB-2PN
Momentary Door Release Push Button	Alarm Controls	TS-18 (or equivalent)
Duress / Panic Button	Honeywell	269R (or equivalent)
Recessed Door Position Contact	Bosch	ISN-CSD80 (or equivalent)
Track Mounted Garage Door Contact	Bosch	ISN-C66 (or equivalent)

B. Equipment lists are provided to set equipment expectations and may not be complete. Coordinate with devices shown on drawings, system risers and equipment list for system intent. Provide a complete and functional system as described within the construction documents.

1. DIV.28 to provide all integrated credential card readers/electrified lockset combinations.
2. DIV.28 shall provide all the power supplies and rechargeable back-up batteries for the electrified door hardware equipment. Coordinate with the DIV.8 for the exact power requirements.
3. DIV.8 shall coordinate with the DIV.28, DIV.26, owner, and the architect for the door hardware that is going to be provided and getting installed.
4. The Div.28 access control installation contractor shall provide all door position contacts, request to exit motions, push to exit buttons, duress/panic buttons, door release buttons, that tie into and operate with the access control system.
5. Provide 1 year of software updates for access control software.

2.3 POWER SUPPLIES:

- A. The DC voltage power supply shall provide dual output fused ports of either 12 or 24 VDC and receive its power input from 120VAC. Units shall be expandable by adding additional modules for up to three power modules. Power modules shall provide power capabilities from 75 to 250W. The system shall provide configurations for power distribution, control & signaling, fire alarm interface, fail safe/fail secure locking control, and shall be a standard feature of the system.
- B. Locate separate power supplies by the head-end access control panels. Provide additional enclosures if needed.
- C. Provide all electrified access control power supplies and door hardware power supplies with 12V rechargeable sealed lead acid backup batteries that will provide minimum standby power capacity for 24 hours.
- D. Provide one specified category cable to each panel for remote functionality such as control, status reporting, information logging, remote battery testing, fault reporting / restore, and shall interface with multiple control and monitoring modules to extend the remote functionality to multiple individual outputs for direct control, extended information gathering and reporting.
- E. It is the Division 28 access control contractor responsibility to provide power supplies for all of the electrified door hardware equipment, electric locks, access control head-end panels, and any other access control devices, to provide a complete and a fully functional access

control system.

2.4 CREDENTIAL CARD READERS:

- A. Connect contactless smart card reader with pigtail cable.
- B. Tamper detection on card readers shall be programmed to send notification through access control system in the event of damage or tampering.
- C. The credential card reader must support and operate with mobile phone credentials.
- D. Mount credential card readers on a 4 square j-box with a single gang mud ring. Do not provide a j-box for mullion style credential card readers, route the readers wiring through the door frames mullion.

PART 3 – EXECUTION

3.1 INSTALLATION OF ACCESS CONTROL SYSTEM:

- A. **GENERAL:** Install the access control system as indicated, in accordance with the equipment manufacturer's specifications, written instructions, and with recognized industry practices, to ensure that system equipment complies with requirements.
- B. Comply with applicable portions of the NEC regarding the types of products that are being used and installed. And to the NECA's "Standards of Installation" recognized industry practices, to ensure that system components are installed correctly and safely.
- C. Prior to starting any work, coordinate and verify the access control layout, wiring, equipment device locations, and mounting details with the owner, architect, and any other trades and suppliers that are applicable, and get written approval.
- D. **COORDINATION MEETINGS:**
 - 1. Meet at least twice with the door hardware systems installer. Hold the first meeting before the submittal of shop drawings to coordinate electronic door hardware components for each door, rough-in requirements, and door schedules. Hold the second meeting before the physical installation of components to verify raceway and cabling, equipment list, any changes have been accounted for, and site conditions for each area.
 - 2. Review and coordinate access control system layout and wiring with owner.
- E. **NETWORK DEVICES:** Provide network cable(s) to any networked devices for access control system and coordinate terminations.
- F. **Grounding:** Provide grounding connections sufficiently tight to assure permanent and effective ground.
- G. **Testing:** Upon completion of installation of system and after energized, demonstrate system compliance with intent.
- H. **WIRING & TERMINATIONS:** All components of this system will need to be in accordance with the manufacture's specifications & recommendations. All final connections shall be made by a qualified & certified technician familiar with the manufacture's equipment and adhering to the owner's procedures.
- I. **ON-SITE EQUIPMENT:** The contractor shall provide their own installation equipment unless they have written permission from the owner to use any of the owner's equipment (lifts, ladders, tools, etc.) onsite. It is the contractor's responsibility to provide all labor and equipment costs in their proposals.
- J. **ZONING:** Each detector, door position switch, and sensing device shall be considered a location. Multiple doors at a common entry can be considered one location. The system shall be programmed to log and detect individual status of a monitored door based on a schedule.

Doors with a door contact must have the ability to receive alerts for that specific opening if the door is opened during a certain time and/or left open for a specific time (60 seconds).

- K. LABELING: The contractor shall develop and submit for approval a labeling system for the cable installation. Coordinate with the owner and negotiate an appropriate labeling scheme with the contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels, and wall plates. The labeling system shall designate the cable's origin and destination and a unique identifier for the cable within the system. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
 - 1. All labels shall meet UL 969 requirements for legibility, defacement, and adhesion requirements. Handwritten labels are not allowed. All labels shall maintain consistent typeface, size, and color.
 - 2. Provide laminated plans (minimum size 11x17) of all Security Systems as-built plans (including riser diagrams) at each telecom room/panel location.
- L. Occupancy Adjustments: When required within one year of date of substantial completion, provide on-site assistance in adjusting and reprogramming to suit actual occupied conditions. Provide 1 visit to the site for this purpose without additional cost.
- M. Mounting Height: Credential card readers and intercoms should meet all ADA mounting requirements. Card readers shall be mounted 48" from the floor to the top of the card reader.
- N. Roof Access Hatch/Door: Verify each roof access hatch/door location with the owner and install a door position contact on each one. Each roof hatch door position contact shall be tied into the access control system, and into the intrusion detection system that will provide a scheduled notification when opened.
- O. Request to Exit Motions: Prior to installation coordinate with the owner the location of the request to exit motions above the door.
- P. Provide all relays required to tie access control system into fire alarm system.
- Q. ADA OPERATION: The security contractor is responsible for integrating access control and ADA operators. coordinate with the owner, Division 8 and 26 contractors to for operation and functionality.
 - 1. ADA Door Opener/Actuator: Provide connection to door opener/actuator to access control system. Program credential card reader and ADA operator per IBC requirements. Provide all necessary cabling, relays, and equipment from the ADA operators and actuators to tie into access control system. Program credential card reader and ADA operator to operate per the Owner's requirements. At a minimum, the ADA actuator shall be disabled during lockout and closure periods.

3.2 WIRING:

- A. Pathway Requirements:
 - 1. See specification 28 0501 for requirements.
- B. Cabling:
 - 1. See specification 27-1500 for category cable requirements.
 - 2. The access control cabling outer jacketing shall be Yellow in color, UL listed, and CMP rated.
 - 3. Access Control Composite Cabling - Provide the following cabling from the access control system head-end panel(s) to the junction box located above each door that has access control door hardware equipment installed on them:
 - a. Access Control Composite Cable: Windy City Wire, UL Listed, Plenum Rated #4461030-OSDP.

4. Provide the following cables from end devices up to the j-box that is located on the secure side of the door in accessible ceiling space:
 - a. Credential Card Reader: 22/1P OAS Lo-Cap, RS-485, 120 Ohms + 18-02 Twisted Non-Shielded, Jacketed, UL listed, Stranded, & CMP rated (OSDP)
 - b. Request for Exit Motion: 4/C, 22 AWG, Stranded, CMP, UL listed.
 - c. Electrified Door Hardware Equipment: 4/C, 18AWG, Stranded, CMP rated, UL listed.
 - d. Door Position Contact: 2/C, 22 AWG, Stranded, CMP rated, UL listed.
 - e. Panic / Duress Button, Push to Exit Button, Momentary Door Release Button: 4/C, 18 AWG, Stranded, CMP Rated, & UL Listed.
5. Wiring by Divisions 26: The electrical connections/terminations for certain equipment provided under door hardware divisions has not been specifically indicated on the electrical drawings and must be provided by and field coordinated by the door hardware trade requiring such electrical connections. Electrical contractors shall review architectural drawing, and door hardware specifications and coordinate with said contractors to confirm electrical needs.

3.3 SYSTEM PROGRAMMING AND COMMISSIONING:

- A. Configure and program the system for full operation. Include owner in the process as much as feasible to understand their intended operation and insure full transfer of operations to them.
- B. Provide a fully functional access control system to ensure the entire system is operating as intended and in accordance with school district policy. Label cables on both ends in all boxes, panels, and racks according to the school district standards.
- C. The contractor shall include in the base contract all costs required to program lockdown procedures based on the owner's requirements and direction.
- D. The contractor shall include necessary programming for fire-alarm panel tie-in and door release based upon the requirements and direction of the owner and/or AHJ.
- E. Contractor shall input database of all required card holders and desired schedules for users and/or groups. It is the contractor's responsibility to coordinate with the owner on which card holders have access to which openings.

END OF SECTION 28 2205

SECTION 28 2301 - VIDEO SURVEILLANCE SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division – 26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Provide a complete and operating IP camera and video surveillance system as indicated in the drawings and plans, and is hereby defined to include, but not be limited to: IP cameras, mounting hardware, IP licenses, network video recorder, video management system operating software, analytics software and licensing, workstations, monitors, keyboard & mouse, power supplies, jacks, input plates, mobile clients, access control system integration, intrusion detection system integration, IP two-way audio video intercom system integration, protective enclosures, and all wiring that is normally and reasonably required.
- B. The work of this section includes electrical raceways (minimum ¾" conduit), boxes and fittings, as specified in applicable Division-26 Basic Materials and Methods section, which are used to enclose surveillance cabling.

1.3 QUALITY ASSURANCE:

- A. The installation contractor shall have at least five years of successful installation experience on projects with surveillance system installation work similar to that required for this product.
- B. NEC Compliance: Comply with applicable requirements pertaining to radio and surveillance equipment and signal distribution.
- C. UL Compliance: Comply with applicable requirements of UL safety standards, pertaining to surveillance equipment and accessories. Provide surveillance equipment and accessories which are UL-Listed and labeled

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on surveillance and recording systems including roughing-in diagrams and instructions for installation, operating and maintenance, suitable for inclusion in maintenance manuals. Also include standard or typical riser and complete wiring diagrams for control and system components.
- B. Shop Drawings: Provide shop drawings showing equipment/device locations and connecting wiring of entire surveillance system. Include wiring diagrams and riser diagrams.
- C. Provide to the Owner the following:
 - 1. A complete set of shop drawings indicating: Locations of all cameras, power supplies and controllers; point-to-point wiring diagrams for all devices.

2. Wiring diagrams for: Cameras, environmental enclosures, pan-tilt-zoom mounts (if applicable); controllers; auxiliary devices.
3. A complete equipment list identifying: Type; model; manufacturer; manufacturer's data sheets.

PART 2 - PRODUCTS

2.1 PROVIDE EQUIPMENT AS FOLLOWS IN QUANTITIES AS SHOWN IN DRAWING:

- A. APPROVED EQUIPMENT MANUFACTURES & MODELS:
 1. IP SURVEILLANCE CAMERAS
 - a. AXIS Communications
 - i. P3265-V
 - ii. P3265-LVE
 - b. Exact camera locations, heights, and camera views will need to be coordinated, verified, and signed off prior to installation with the school/owner.
 - c. Verify that all mounting brackets, wall brackets and pendant kits are compatible with the cameras before installation. Refer to the Video Surveillance Type Schedule for the camera types, and mounting suggestions.
 - d. Install and configure the specified analytics, optimizing them for the camera environment.
 - e. Name all the IP surveillance cameras and views to the owner's requirements.
 2. IP Two-Way Audio Video Intercom
 - a. 2N
 - i. IP Solo Door Station
 - b. Provide one door station at each location as shown on the plans.
 - c. Provide one specified CAT6 category cable to the designated equipment rack, and two 18/4 cables to the access control head-end panel. Tie these intercoms so they operate with the video surveillance system, the access control system, and with the school's SIP phone system.
 - d. Terminate and program intercom per manufacturer's specification and instructions, and to the owner's requirements.
- B. NETWORK CAT6 CABLING:
 1. Provide one specified CAT6 category cable that is plenum rated and has an orange overall jacket from each IP surveillance camera that homeruns back to the designated equipment rack and terminate them to the assigned patch panel. (See specifications in Division 27 1500).
- C. VMS & IP CAMERA LICENSES:
 1. MILESTONE SYSTEMS
 - a. Provide video management software to include all camera licensing fees and upgrade agreements for at least 1 year. Install and configure all software on the network video recorder and workstations as required for owner use.
 - b. Contractor to ensure all software is on the latest firmware and version of video management software.
 - c. Prior to starting any work coordinate & verify with Jordan School District, Ron Mousley, on which version of the Milestone XProtect Video Management System Operating Software they use and confirm the quantity of IP camera licenses they will need for this project.

- D. NETWORK VIDEO RECORDER REQUIREMENTS:
1. Rack Mounted Computer Server:
 - a. Minimum - Intel Core i5, Quad-Core, 2.8GHZ processor or better (more powerful CPU recommended for Client Viewer running higher number of cameras)
 - b. RAM – Minimum of 16GB
 - c. Network – Minimum 2 gigabit network ports
 - d. Graphics Adapter – Minimum 1280x1024 (2560x1600 max), 2 HDMI, 2 DVI
 - e. Hard Disk Space (minimum – OS: 80GB+, Live: 200GB+, Archive: 6TB on (2) 3TB drives+
 - f. Hard Disk Drive Configuration – JBOD
 - g. Operating System – Windows 10 Enterprise 64 bit
 - h. Software – Microsoft .NET 4.0 DirectX 9.0 or newer
 2. One rack mounted 19" LCD monitor with keyboard mouse sliding console drawer.
 3. On the network video recorder (NVR) server set it up so the video recording storage shall be recorded on separate hard drives, different from the hard drives used for the computer's operating system and the video management system operating software.
 4. The system shall allow archiving to be enabled on a per camera basis and allow the user to define which archiving drive shall be used for each camera. The Hard Disk Drive storing the Archive Database.
 5. The Recording Server shall have multiple Network Interface Cards (NIC) and support connection to the cameras on a network separate from the Client Viewer, Management Server and System Manager.
 6. The Recording Server shall have the ability to accept the full frame rate supplied by the cameras, while recording a lower frame rate, yet still make the higher frame rate available to the Clients for live viewing.
 7. Contractor is to train the authorized personnel how to perform all necessary functions of the video surveillance system.
 8. Provide server calculations from Video Management System provider and camera manufacturer to validate proper server configuration and hard drive storage in submittals.

PART 3 – EXECUTION

3.1 INSTALLATION OF SURVEILLANCE SYSTEMS:

- A. Install surveillance systems in metallic raceway and ancillary equipment as indicated in accordance with equipment manufacturer's written instructions, and the NEC, and with recognized industry practices, to ensure that surveillance systems fulfill requirements.
- B. No exposed conduit shall be allowed on the interior or exterior e.g. EMT, liquid-tight, boxes, etc. For any exterior mounted camera, contractor shall locate a junction box on the interior wall furring with a 10' category cable service loop and terminated in a surface mount box. Coordinate opening the backside of camera mount and drill (large enough to route unterminated category cable) through straight through exterior facade and provide black IP67-rated weatherproof stranded CAT6 cable assembly and route through wall and terminate at cable at through weatherproof connection on camera and interior surface mount box. Provide weatherproof sealant around drilled hole as required.
- C. Coordinate with other work, including raceways, and electrical boxes and fittings work, as necessary to interface installation of surveillance systems with other work.

- D. Use extreme care in handling, fishing and pulling-in cable to avoid damage to cable and shield. Avoid excessive number of bends and sharp bends.
- E. Install individual cables from each camera to the closest data termination rack.
- F. Coordinate installation of computer and monitor.

3.2 GROUNDING:

- A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for system components, as indicated.

3.3 FIELD QUALITY CONTROL:

- A. Testing: Upon completion of installation of surveillance system and after electrical circuitry has been energized, test compatibility and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace them with new units, and proceed with retesting.

3.4 TRAINING:

- A. The contractor shall include in the base contract all costs required to train the owner in the use and maintenance of systems provided under this division of the specifications.

3.5 WARRANTY:

- A. Provide one year parts and on-site labor warranty.

END OF SECTION 28 2205

SECTION 28 3111 - FIRE ALARM AND DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Provide a new addressable fire alarm and detection system.
 - 1. Provide and install NAC/booster panels as needed throughout the project.
- B. Provide new duct smoke detectors and fan relays at all fan units 2000 CFM and over. Shut down all supply and return fans upon a general alarm signal.
- C. Provide laser-based air sampling/very early warning smoke detection as specified herein. System to be utilized for open area coverage with sampling points placed in piping at locations where smoke detectors are required by NFPA standards.
- D. Install all wiring in steel conduit (3/4" minimum). All conduit runs shall form a complete loop from the fire alarm control panel.
- E. Provide vandal resistant cages to protect horn/strobes, smoke and heat detectors as indicated on drawings and, in gyms whether shown or not. Securely fasten security cages as required. Provide backing and bracing as required to ensure that attachment extends beyond the ceiling materials. Cages shall have two pieces, one backplate and one cover to attach to backplate. Provide cages/guards on horn/strobes that are clear and do not limit their effect on the field performance with the listing requirements.
- F. Comply with NEC as applicable to construction and installation of fire alarm and detection system components and accessories. Provide components and systems, which are UL-listed and labeled for fire alarm. Provide fire alarm and detection systems and accessories, which are FM approved. Comply with State and local requirements as applicable.
- G. The fire alarm system supplier shall be UL, UUJS Listed as a Local, Auxiliary, Remote Station, and Proprietary Signaling Services company. The UL Certification number shall be submitted with the bid documentation.
- H. The project shall be UL Certificated. Upon completion of the project, provide to the owner, a certificate from the UL Listed supplier with the project specific certificate. Certificate and number shall be documented and included as part of the closeout documentation.
- I. Ensure that the fire alarm supplier has a minimum of (1) NICET Level IV, and (3) NICET Level III technicians on staff.
- J. Comply with applicable provisions of current NFPA Standard 72 National Fire Alarm and Signaling Code (as applicable), local building codes, the most current adopted revision of the International Building Code (IBC), the International Fire Code (IFC), the

International Mechanical Code (IMC), and meet requirements of local authorities having jurisdiction.

- K. Carefully review all Division 23 drawings for all fire/smoke dampers. Fire/smoke dampers are NOT shown on electrical plans. Electrical contractor is responsible for coordinating 120V emergency power to all dampers and providing fire alarm connections to each one. See mechanical drawings for all locations.
- L. Provide a fire alarm duct detector within 5-feet of any fire/smoke damper as required to comply with IMC 607.5.4.1. The duct detector shall be listed for the air velocity, temperature and humidity at the point where it is to be installed. A duct detector will not be required at a fire/smoke damper located on a corridor wall where the corridor has smoke detection devices installed. For dampers installed within an un-ducted opening in a wall, a spot-type detector listed for releasing service shall be installed within 5-feet horizontally of the damper. Provide a fire alarm relay at each fire/smoke damper. Provide a test switch at each location where the damper is located above an inaccessible ceiling or is located more than 10 feet above the finished floor. Coordinate the location of test switches with owner/architect.
- M. Provide all CO detectors serving mechanical rooftop equipment with a monitor module and relay and shut down the unit served by the CO detector.

1.3 SUBMITTALS: Refer to Section 26 0503 for requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. MANUFACTURER: Provide fire alarm and detection system of Gamewell-FCI; By Nelson Fire Systems. Fire alarm supplier shall be Gamewell-FCI Platinum Level Distributor.

2.2 FIRE ALARM AND DETECTION SYSTEMS:

- A. GENERAL: Provide an electrically operated, electrically supervised fire alarm system as described herein. Include control units, power supplies, alarm initiating and indicating devices, conduit, wire, fittings and accessories required to provide a complete operating system. Enclose entire system in raceway. Provide basic wiring materials which comply with Division 26, Basic Materials and Methods Sections for raceways, conductors, boxes, fittings, supports, etc. Minimum wire size to be #14 AWG copper.
- B. SYSTEM TYPE: Analog addressable, non-coded. Either manual activation of a fire alarm station or activation of an automatic initiating device energizes all fire alarm signaling devices, sounding a non-coded alarm and providing device identification on an annunciator panel.
- C. SYSTEM OPERATION: Provide system such that any manual station or automatic initiating device annunciates all alarm indicating units (bells, horns, buzzers, chimes, visual alarm lamps, etc.) continuously until the manual station or initiating device is restored to normal and the fire alarm control unit reset. Annunciate alarm signals by device at the control panel and all remote annunciators. Provide all conductors, raceway, equipment and labor to accomplish the following:
- D. Deactivate air supply and return fan units simultaneously by means of a supervised master fan shutdown relay with slave relays as required. Restart air units automatically after panel has been reset. Provide a bypass switch for master fan shut down relay for drill purposes, and indicate by a locked-in lamp that the circuit has been bypassed.

- E. Selectively activate and/or deactivate fan units as required.
- F. Release all magnetic door holders upon activation of an alarm from any device by use of a master relay in the control panel.
- G. Provide supervised circuits for the following:
 - 1. Close dampers upon activation of an alarm from any device through the HVAC interface relays at the Fire Command Center.
 - 2. Recall elevators, upon activation of an alarm, to the floor of building egress unless the alarm is on the egress floor, in which case recall elevator to the level designated by the Fire Marshall. Cooperate with the elevator supplier to ensure complete operable system. Provide shunt trip breaker(s) as required.
- H. Central Station Monitoring. Provide an interface to the building security panel for fire alarm signal transmission to the district central station. Provide dry contacts at the main fire alarm control unit for 'Alarm', 'Supervisory', and 'Trouble'. Connections shall be supervised by the security alarm panel.
- I. Provide fire alarm control panel with capability of shutting down individual initiating devices for maintenance purposes without affecting the continued operation of other initiating devices.
- J. Provide manual fire alarm stations in boiler rooms, kitchen and main administrative office.
- K. Provide external alarm horns sufficient to be heard in all outdoor within the vicinity of the building.
- L. Sprinkler Supervision. Provide a signal initiating and supervisory circuit to each PIV (post indicator) valve, and to each sprinkler riser and subdivision. Provide continuous alarm signal upon actuation of any water flow signal initiating device. Sound alarm until the condition has been corrected and the panel manually reset as required by UL864. Provide separate alarm zones for: (1) alarm zones from "waterflow alarms", (2) alarm zones from "supervisory alarm" indicating sprinkler system trouble. Provide 120 VAC power to all alarm bells furnished under Division 23. Review final fire sprinkler drawings and coordinate for panel, flow and tamper switch locations.
- M. Provide relays, monitor modules and connections as required at control panel of kitchen hood suppression system for initiation of alarm signal to fire alarm control panel. Connect hood suppression control panel to shunt trip breakers as required.
- N. Provide all required wiring from gas shut off valve to the hood suppression control panel. Make all connections to insure a properly operating system. Verify with Mechanical Contractor.

2.3 FIRE ALARM CONTROL PANEL:

- A. The fire alarm control panel shall be microprocessor-based. Each loop shall be capable of 159 analog addresses and 159 monitor and/or control addresses.
- B. The fire alarm control panel shall contain a 80 digit alphanumeric display and permit the user to perform all necessary functions including but not limited to the following:
 - 1. Alarm/Trouble Acknowledge.

2. Alarm Silence
 3. Reset
 4. Lamp Test
 5. Control of Initiating Devices (on/off)
 6. Control of output modules (on/off)
 7. Change sensitivity of devices
 8. Change time
 9. Walk test
 10. View 4000 event history log.
- C. The fire alarm control panel shall be capable of alarm verification. The control panel shall indicate which smoke detector is in alarm during the pre-alarm window.
- D. All alarm signals shall be locked in at the panel until the operated device is returned to it's normal condition and the control panel is manually reset.
- E. Alarm or trouble activation of initiating points shall be represented in English on the alphanumeric display on both the remote operating panel and the fire alarm control panel indicating the address of the specific device, i.e. Device L4S76, Smoke Detector, 1st floor Rm. 17.
- F. Each initiating and signal circuit shall be electrically supervised for opens, shorts, and ground faults in the wiring.
- G. The occurrence of any fault shall activate the system trouble circuitry but shall not interfere with the proper operation of any circuit that does not have a fault condition.
- H. The system communication loops shall be capable of being wired using Class "A" (Style 6) supervised circuits (a ground fault on either conductor or a break shall not prevent a device from operating on either side of the break)
- I. The fire alarm control panel shall contain circuitry permitting the transmission of trouble and alarm signals over leased phone lines by the means of reverse polarity. There shall be a supervised disconnect switch to allow testing of the fire alarm control panel without transmitting an alarm to the central station.
- J. The fire alarm control panel shall include the following features.
1. Auxiliary SPDT fire alarm actuated contacts.
 2. Auxiliary SPDT supervisory alarm actuated contacts.
 3. Auxiliary SPDT trouble actuated contacts.
 4. A solid-state power transfer circuit that shall switch to standby power automatically and instantaneously if normal power fails or falls below 15% of normal ("brown out" conditions). This electronic circuit shall allow the batteries to be effectively "floated" on the operating system to avoid upsetting the normal microprocessor scan and minimize resultant nuisance troubles and/or alarms.
 5. A ground fault detector to detect positive or negative grounds on the initiating circuits, signal circuits, power circuits, and telephone line circuit. A ground fault code on the alphanumeric display shall provide indication of either a positive or negative ground fault and shall operate a general trouble but shall not cause an alarm to be sounded.

6. A short circuit error message shall be a standard feature of the fire alarm control panel. Each communication loop shall be monitored and shall have a distinctive error message.
 7. Lightning protection shall be a standard feature of the fire alarm control panel and shall be incorporated in the power supply circuit, common control circuits, signal circuits, and telephone line circuit.
 8. Individual PTC overcurrent protection shall be provided for the following: smoke detector power, main power supply, signal circuit #1, signal circuit #2, battery standby power, and auxiliary output.
 9. The fire alarm control panel shall be of dead-front construction. One key shall allow access to all operator functions.
 10. Opening the main door shall expose all components for inspection or adjustment without further dismantling of the cabinet, control unit, or wiring.
 11. It shall be possible to check and adjust the sensitivity of all analog devices from the main fire alarm panel.
- K. The fire alarm control panel shall have batteries capable of powering the system for (24) hours in standby condition and (5) minutes in alarm.
- L. There shall be no special tools required for the programming of devices. A standard slot head screwdriver only.
- M. Provide (16) separate bypass switches for the functions listed below with separate red, green, and yellow LED's per switch:
- Strobe/Horn bypass
 - Fan/Damper shutdown bypass
 - Door holder bypass
 - Separate switch for each addressable loop bypass
- Owner shall designate purpose for any unused switches.
- N. Provide one (1) Gamewell-FCI ANX-SR and one (1) Gamewell-FCI FP-GATE-3 for interface to existing district Gamewell-FCI FocalPoint system. Provide new graphics and populate all new fire alarm system point information. Test communication signals from building to FocalPoint system. Two (2) network IP addresses at the new fire alarm control unit will be required for connection to the FocalPoint system. Coordinate with the district IT department for network connections.
- O. In the event of a power outage, the control panel shall be capable of storing and printing the last 4000 events, including during the power outage.

2.4 REMOTE OPERATING PANEL: Gamewell-FCI Model: LCD-E3

- A. Remote Operating Panel (Provide color as selected by Architect)
- B. The Remote Operating Panel shall contain 80 digit alphanumeric display providing status of all devices including the fire alarm control panel.
- C. The Remote Operating Panel shall permit the user to perform all necessary functions including but not limited to the following:

1. Alarm/Trouble Acknowledge
2. Alarm Silence
3. Reset
4. Lamp Test
5. Control of Initiating Devices (on/off)
6. Control of Output Modules (on/off)
7. View Event Log
8. Change time
9. Walk test

2.5 MONITOR MODULE: Gamewell-FCI Model: AMM-2F/AMM-4F

- A. Remote identification module devices shall be attached to any single normally open initiating device (heat detector, waterflow switch, duct detectors, sprinkler, tamper switches, kitchen hood, pull station, etc.). The modules shall supply addressing and status information to the Fire Alarm Control Panel through the signaling line circuit.

2.6 CONTROL POINT MODULE: Gamewell-FCI Model: AOM-2RF

- A. The control point module shall be connected to the same loop as the initiating devices, and shall provide two relay outputs (Form "C" 2 Amp @ 30 VDC, resistive only).
- B. This relay output shall be used to perform auxiliary functions.
- C. When the AOM is activated, the red "ACTIVE" LED shall be on solid. Under normal conditions, the green "ON LINE" LED shall flash.

2.7 DOOR HOLDER: Gamewell-FCI Model: DH-FC1

- A. The door holder shall be wall mounted, semi-recessed; be powered at 120 VAC; and have 35 lbs. of holding force and be of a brushed aluminum finish.

2.8 MANUAL FIRE ALARM STATION: Gamewell-FCI Model: MS-7AF

- A. Provide red enclosure, manual fire alarm stations with the following features:
 1. suitable for semi-flush mounting.
 2. Addressable alarm type electrically compatible with system requirements.
 3. Double Action

2.9 PHOTOELECTRIC DETECTORS (GAMEWELL-FCI: ASD-P W/ADB-PL2F W/B210LP BASE):

- A. All photoelectric detectors shall be capable of being replaced without disconnecting any wires or wire connectors from the base of the detector. Each detector shall be installed on a separate base. The detector base shall be capable of receiving a photoelectric, ionization, or electronic thermal detector. All photoelectric detectors shall be UL 268 listed. All detectors shall have two viewable LEDs to indicate the status of the device.

2.10 DUCT FIRE DETECTORS: Gamewell-FCI Model: DNR

- A. Provide photoelectric type with UL 268A listings. If duct smoke detector is not readily accessible, provide with a remote indicating light and remote test station.

2.11 THERMAL DETECTORS: Gamewell-FCI Model: ATD-RL2F

- A. Thermal detectors shall operate on the Rate-of-Rise principal. The detectors shall have a fixed temperature rating of 135 degrees Fahrenheit. Exception: in Boiler rooms, provide temperature rating of 200 degrees Fahrenheit.
 - 1. The heat detector shall consist of a base and a head.
 - 2. The base shall be capable of accepting either a smoke detector or a 135 (or 200) degree heat detector.
 - 3. The head shall automatically restore to its normal standby condition when the temperature returns to its normal range.

2.12 AUDIOVISUAL ALARM HORNS: Gamewell-FCI Model: P2W/P2RK

- A. Provide audio-visual alarm horns with selectable multi-candela strobes (15/30/75/110 cd) and selectable horn (90 or 95 dba). Provide outdoor devices listed for exterior use. Provide white devices inside and red devices outside. Synchronize all strobes.

2.13 VISUAL ALARM STROBES: Gamewell-FCI Model: SW

- A. Provide visual alarm strobes with selectable multi-candela strobes (15/30/75/110 cd). Provide white devices. Synchronize all strobes.

2.14 CARBON MONOXIDE (CO):

- A. Provide a System Sensor CO1224T carbon monoxide detector with Realtest Technology. Provide detectors with the following features:
 - 1. Compliance with UL2075.
 - 2. Trouble relay.
 - 3. Wiring supervision with SEMS Terminals.
 - 4. A six year end-of-life timer.
 - 5. Sounder base for sound audible alarm.

2.15 VISUAL ALARM STROBE (CO detection) (Gamewell-FCI Model SCW-P)

- A. Provide a white ceiling mounted visual alarm strobe with a CO label and a blue lens #LENS-BC.

2.16 AUXILIARY RELAY: Gamewell-FCI Model: PR-1

- A. Remote auxiliary relay boards shall be rated at 10 AMPS @ 120 VAC. A red LED shall light to indicate relay activation. All relays shall transfer on general alarm and latch on until reset. All relays shall be supervised. The control output provided can be used in conjunction with fire alarm applications (i.e. fan controls, dampers, doors, and any other general alarm control).

2.17 INITIATING MODULES: Gamewell-FCI Model: AMM-4F

- A. Provide style "6" initiating modules capable of receiving and annunciating an alarm from any detector, even with a single fault condition on any initiating circuit.
- B. Power all smoke detectors from the "Style 6" initiating loop wiring. For systems which power smoke detectors separately from the "Style 6" loop, provide monitoring for both the power source and the independent initiating wiring, so that complete trouble and

alarm indication is achieved by loop. Provide capability to operate all smoke detectors, even with a single fault condition on the smoke detector power wiring.

2.18 SIGNALING MODULES: Gamewell-FCI Model: AOM-2SF

- A. Provide signaling as required. Provide power adequate to sound all signaling devices concurrently. Provide supervised indicating circuits for polarized 24V D.C. alarm signaling devices.

2.19 SUPPLEMENTAL NOTIFICATION CIRCUITS: Gamewell-FCI Model: HPFF8

- A. Provide supplementary notification appliance circuit panel(s) as required. The 'SNAC' shall be capable of supplying up to four Class A, Style Z notification appliance circuits. The panel shall contain its own battery charger, regulated power supply, and shall be supervised for ground fault, overcurrent, open circuits and low battery conditions. Ground fault, battery and circuit trouble conditions shall transmit a trouble signal to the main fire alarm control panel.
Locate all Supplementary Notification Appliance Circuit power supplies as indicated on drawings.

2.20 SYSTEM CONFIGURATION PROGRAMMING:

- A. To help the owner in programming, system changes, and servicing, the fire alarm system shall have the following functions:
 - 1. The FACP shall be capable of an auto-configuration, which, via a password, all analog devices and panel modules are automatically programmed into the system. At this point the system will operate as a general alarm system without any other programming.
 - 2. If any two devices are addressed the same, the LED's on both devices will light steady and the panel will read "extra address with the address number".
 - 3. If any device is installed and not programmed into the system, the LED will light steady and the panel will read the same as above.

2.21 BATTERIES/POWER SUPPLIES:

- A. Provide standby batteries capable of operating fire alarm system for minimum of 24 hours, then operating all indicating units for at least five minutes. Locate batteries in fire alarm control unit, or in similar type enclosure located as directed. Provide all interconnecting wiring. Place batteries which vent hydrogen gas in separate enclosure. Provide 30 percent spare capacity.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS:

- A. Install fire alarm and detection systems as indicated, in accordance with equipment manufacturer's written instructions and complying with applicable portions of NEC and NECA's "standard of installation".

- B. Install wiring, raceways, and electrical boxes and fittings in accordance with Division 26 Basic Materials and Methods section, “Raceways”, “Wires and Cables”, and “Electrical Boxes and Fittings”, and in accordance with other sections, as applicable. Label all junction boxes “F.A.” and paint box and cover red, per Section 16135.
- C. All wire used on the fire alarm system shall be U.L. Listed as fire alarm protective signaling circuit cable per NEC, Article 760.
- D. If twisted or shielded wire is required or recommended by the manufacturer it must be used.
- E. Review proper installation procedure for each type of device with equipment supplier before installation.
- F. Provide Two (2) network IP addresses at the new fire alarm control unit for connection to the FocalPoint system. Coordinate with the district IT department for network connections.
- G. Coordinate the mechanical units that are protected by Carbon Monoxide Detectors and shut down the unit upon detection of CO. Verify exact requirements with the Fire Marshal.
- H. Label the end of wires in all boxes including panel, power supplies, pull boxes, etc.V
- I. Label circuit breaker feeding fire alarm panel: “Fire alarm circuit”. Use plastic laminate label, white letters on red background.
- J. Where smoke or heat detectors are specified, install device a minimum of three feet from adjacent air supply diffusers to ensure proper operation of device.
- K. Refer to NFPA for spacing and exact placement of fire alarm devices.
- L. Provide one set of approved, stamped, fire alarm system drawings on site throughout construction, and make available for Fire Marshal reference.
- M. Upon completion of the Fire Alarm System Installation, a test of the entire fire alarm and CO monitoring system is required prior to a scheduled inspection in the presence of a representative from the Utah State Fire Marshal’s Office. Include a 24-hour secondary power test.
- N. Provide one set of instructions on operation of the Fire Alarm System and one set of the As-Built Drawings in a cabinet, located at or near the Fire Alarm Control Unit (FACU), or Fire Alarm Control Panel (FACP) as approved by the Architect and Fire Marshal. Label the cabinet “SYSTEM RECORD DOCUMENTS”.

3.2 GUARANTEE:

- A. Furnish a three-year guarantee for all equipment, materials and installation, including all labor, transportation, and equipment.
- B. Emergency Response. The fire alarm equipment supplier shall provide an emergency response within four hours of any reported system failure to resolve the problem on a continuous basis.

3.3 PRE-TEST:

- A. The contractor shall with a representative of the manufacturer conduct a test 3 days before the final test to verify operation of all devices. Any problems must be corrected before the final test.

3.4 FINAL TEST:

- A. Before the installation shall be considered completed and acceptable, a test on the system shall be performed as follows:
 - 1. The contractor's job foreman, a representative of the manufacturer, a representative of the owner, shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel. Fan shutdown and door holder circuits shall operate.
 - 2. Conduct a full 24 hour test of battery operation. System shall be put on the batteries for a full 24 hours and all notification appliances shall be operational for a period of 5 minutes.
 - 3. The supervisory circuitry of the initiating and indicating circuits shall also be verified.
 - 4. Provide printout demonstrating successful performance of all devices.

3.5 LABELING:

- A. All devices shall be labeled with their appropriate address. The labels shall be 18 point pressure sensitive labels.
- B. All initiating devices shall be programmed to include the device address and a complete user text English location description, i.e. Device L4S76, Smoke Detector, 1st floor Rm.17.
- C. Label the end of all wires in all boxes including panels, power supplies, pull boxes, etc.

3.6 AS BUILT DRAWINGS:

- A. A complete set of CAD "as-built" drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of the system. Vendor shall not request drawings from the Engineer. Vendor shall request current architectural drawings from the Architect and include all cost with bid.
- B. A building map shall be supplied to the owner indicating the exact location of all devices along with the addresses of the individual devices. Install building fire alarm map adjacent to the fire alarm panel and all remote operating panels. Provide high quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall be a clear center for viewing the CAD fire alarm drawing. The building map shall indicate the various devices by the use of different colors (minimum of five colors).
- C. Provide a CD to the Owner containing the information specified below. The CD shall include all information required to allow the Owner to change the fire alarm program themselves. The CD shall contain a minimum of the following:

1. CAD drawing files of building fire alarm map
2. CAD drawing files of as-built fire alarm components and point to point connections.
3. General configuration programming.
4. Job specific configuration programming.

3.7 OPERATING AND MAINTENANCE MANUALS:

- A. Operating and maintenance manuals shall be submitted prior to testing of the system. Manuals shall include all service, installation, and programming information.

3.8 TRAINING:

- A. Provide four (4) hours training on the operation and installation of fire alarm system, at job site, at no cost to owner.

END OF SECTION 16721

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SECTION 310700 GENERAL SITE CONSTRUCTION REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Includes But Not Limited to
 - 1. General procedures and requirements for Site Work.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 PREPARATION

- A. Site Verification Of Conditions
 - 1. 48 hours minimum prior to performing any work on site, contact Blue Stakes to arrange for utility location services.
 - 2. Perform minor, investigative excavations to verify location of various existing underground facilities at sufficient locations to assure that no conflict with the proposed work exists and sufficient clearance is available to avoid damage to existing facilities.
 - 3. Perform investigative excavating 5 days minimum in advance of performing any excavation or underground work.
 - 4. Upon discovery of conflicts or problems with existing facilities, notify Architect by phone or fax within 24 hours. Follow telephone or fax notification with letter and diagrams indicating conflict or problem and sufficient measurements and details to evaluate problem.
 - 5. Notify Owner of utilities a minimum of 48 hours prior to an work taking place.

3.2 PREPARATION

- A. Protection
 - 1. Spillage -
 - a. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways.
 - b. Remove spillage and sweep, wash, or otherwise clean project, streets, and highways.
 - 2. Dust Control -
 - a. Take precautions necessary to prevent dust nuisance, both on-site and adjacent to public and private properties.
 - b. Correct or repair damage caused by dust.
 - 3. Erosion Control -
 - a. Take precautions necessary to prevent erosion and transportation of soil downstream, to adjacent properties, and into on-site or off-site drainage systems.
 - b. Develop, install, and maintain an erosion control plan if required by law.
 - c. Repair and correct damage caused by erosion.
 - 4. Existing Plants And Features - Do not damage tops, trunks, and roots of existing trees and shrubs on site which are intended to remain. Do not use heavy equipment within branch spread. Interfering branches may be removed only with permission of

Architect. Do not damage other plants and features which are to remain.

5. Protect site from fire caused by welding, cutting, smoking, or other sources of ignition.
- B. If specified precautions are not taken or corrections and repairs made promptly, Owner may take such steps as may be deemed necessary and deduct costs of such from monies due to Contractor. Such action or lack of action on Owner's part does not relieve Contractor from responsibility for proper protection of the Work.
- C. Fees
 1. Contractor shall be responsible for all off site street cut fees, encroachment permit fees, and bonding associated with the construction of the proposed facility.

3.3 REPAIR / RESTORATION

- A. Adjust existing covers, boxes, and vaults to grade.
- B. Replace broken or damaged covers, boxes, and vaults.
- C. Independently confirm size, location, and number of covers, boxes, and vaults which require adjustment.

3.4 FIELD QUALITY CONTROL

- A. Notify Architect 48 hours prior to performing excavation or fill work.
- B. If work has been interrupted by weather, scheduling, or other reason, notify Architect 24 hours minimum prior to intended resumption of grading or compacting.
- C. Owner reserves right to require additional testing to re-affirm suitability of completed work including compacted soils which have been exposed to adverse weather conditions.

END OF SECTION 310700

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 1. Removing existing trees, shrubs, groundcovers, plants, and grass as indicated on demolition plan.
 2. Clearing and grubbing.
 3. Stripping and stockpiling topsoil.
 4. Removing above- and below-grade site improvements.
 5. Disconnecting, capping or sealing, abandoning site utilities in place, and removing site utilities.
 6. Temporary erosion and sedimentation control measures.
- B. Related Sections include the following:
 1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security, protection facilities, and temporary erosion and sedimentation control procedures.
 2. Division 01 Section "Temporary Tree and Plant Protection" for protecting trees remaining on-site that are affected by site operations.
 3. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
 4. Division 23 Section "Turf, Grasses, and Plants" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control Drawings, a sediment and erosion control plan, specific to the site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 UTILITIES

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
 - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities.
 - 2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

- E. Removal of underground utilities is included in Division 21, Division 22, Division 26, Division 27, and Division 28 Sections covering site utilities.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 - 4. Use only hand methods for grubbing within tree protection zone.
 - 5. Remove tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Limit height of topsoil stockpiles to 120 inches.
 - 2. Dispose of excess topsoil as specified for waste material disposal.
 - 3. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.6 SITE IMPROVEMENTS

- A. Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction. Refer to project plans for improvements to be abandoned in place.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.7 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
 - 1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing sub-grades for slabs on grade, walks, pavements, lawns and grasses, and exterior plants.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage course for slabs-on-grade.
 - 4. Subbase course for concrete walks and pavements.
 - 5. Subbase and base course for asphalt paving.
 - 6. Subsurface drainage backfill for walls and trenches.
 - 7. Excavating and backfilling for utility trenches.
 - 8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
- B. Related Sections include the following:
 - 1. Division 01 Section Construction Progress Documentation and Photographic Documentation for recording pre-excavation and earthwork progress.
 - 2. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
 - 3. Divisions 21, 22, 23, 26, 27, and 28 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
 - 4. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above-grade and below-grade improvements and utilities.
 - 5. Division 32 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.
 - 6. Division 32 Section "Plants" for planting bed establishment and tree and shrub pit excavation and planting.

1.3 UNIT PRICES

- A. Quantity allowances for earthwork are included in Division 01 Section "Allowances."

1.4 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength 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. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. 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 for unit prices and changes in the work.
 - 2. Bulk Excavation: Excavation more than 10-feet in width and more than 30-feet in length.
 - 3. 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.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, un-stratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cubic yard for bulk excavation or 3/4 cubic yard for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - 1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090-lbf and stick-crowd force of not less than 18,650-lbf; measured according to SAE J-1179.
 - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. 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.
- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of plastic warning tape.
 - 2. Geotextile.
 - 3. Controlled low-strength material, including design mixture.
- B. Samples: 12-by-12-inch Sample of sub-drainage and other geotextiles used.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D698 or ASTM D1557 for each on-site and borrow soil material proposed for fill and backfill.
- D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 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. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM or AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3, or a combination of these groups; free of rock or gravel larger than 3-inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Native rock crushed to meet the above requirements and free from significant porosity may also be used as satisfactory soils.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups. Unsatisfactory soils listed above may not be used.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: 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 sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: UDOT Specification 02721 Class A aggregate consisting of well graded, clean, hard, tough, durable, and sound mineral aggregates consisting of crushed gravel, crushed stone, or crushed slag, free of organic matter and contamination from chemical or petroleum products; with at least 90 percent passing a 1-inch sieve and not more than 11 percent passing a No. 200 sieve. Sand Equivalency of 35 or greater.

Table 1
Aggregate Properties

	Aggregate Class		
	A	B	
Dry Rodded Unit Weight	Not less than 75 lb/ft ³		AASHTO T 19
Liquid Limit/Plastic Index	Non-plastic	PI ≤ 6	AASHTO T 89 AASHTO 90
Aggregate Wear	Not to exceed 50 percent		AASHTO T 96
Gradation	Table 2		AASHTO T 11 AASHTO T 27
CBR with a 10 lb surcharge measured at 0.20 inch penetration	70% Minimum	N/A	AASHTO T 193
Two Fractured Faces	50% Min	N/A	AASHTO T 335

Table 2
Gradation Limits

Sieve Size	Job Mix Gradation Target Band	Job Mix Gradation Tolerance
1½ inch	100	
1 inch	90 - 100	±9.0
¾ inch	70 - 85	±9.0
½ inch	65 - 80	±9.0
¾ inch	55 - 75	±9.0
No. 4	40 - 65	±7.0
No. 16	25 - 40	±5.0
No. 200	7 - 11	±3.0

Percent passing based on total aggregate (dry weight) and fine and coarse aggregate with approximately the same bulk specific gravities.

- F. Structural 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 sieve and not more than 15 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 3/4-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed or crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Non-woven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 - 4. Tear Strength: 56 lbf; ASTM D 4533.
 - 5. Puncture Strength: 56 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: **No. 60** sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
 - 4. Tear Strength: 90 lbf; ASTM D 4533.
 - 5. Puncture Strength: 90 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:
1. Portland Cement: ASTM C 150, Type II.
 2. Fly Ash: ASTM C 618, Class C or F.
 3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch to 3/8-inch nominal maximum aggregate size.
 4. Foaming Agent: ASTM C 869.
 5. Water: ASTM C 94/C 94M.
 6. Air-Entraining Admixture: ASTM C 260.
- B. Produce low-density, controlled low-strength material with the following physical properties:
1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. at point of placement, when tested according to ASTM C 138/C 138M.
 2. Compressive Strength: 80 psi , when tested according to ASTM C 495.

2.4 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows when required by utility purveyor:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.

- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Explosives are not permitted on this project.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs on grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades. Fill placed on existing ground for site walks, pavements and all other improvements shall be placed on 1 foot of processed and recompacted existing material.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons or vehicle with similar unit axel weight.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
- D. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 12 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- E. Place and compact initial backfill of subbase material or satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.
- G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- H. All utility trench backfill shall comply with the plans and specification and any additional requirements of the utility purveyor who will own them at the time they are accepted by the purveyor. See utility purveyors or city standards for additional backfill material requirements.
- I. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- J. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- K. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use structural fill.
 - 4. Under building slabs, use structural fill.
 - 5. Under footings and foundations, use structural fill.

- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 12-inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Reduce loose depths as needed to achieve required compactions.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent if in landscaping areas or 95 percent if under structures, pavements, or walks.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch
 - 3. Pavements: Plus or minus 1/2 inch

- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends where called for on details and on plans.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 - 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 - 5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557 where called for on project plans.

3.18 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
 - 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.
- B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
 - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

SECTION 312319 DEWATERING

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 construction dewatering.
- B. Related Sections:
 - 1. Division 01 Section "Construction Progress Documentation and Photographic Documentation" for recording preexisting conditions and dewatering system progress.
 - 2. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.
 - 3. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
 - 4. Division 33 Section "Subdrainage" for permanent foundation wall, underfloor, and footing drainage.

1.3 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 - 1. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 - 3. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 5. Remove dewatering system when no longer required for construction.

1.4 SUBMITTALS

- A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
 2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
- B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Qualification Data: For qualified Installer.
- D. Field quality-control reports.
- E. Other Informational Submittals:
1. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in dewatering systems and dewatering work.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to dewatering including, but not limited to, the following:
 - a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
 - b. Geotechnical report.
 - c. Proposed site clearing and excavations.
 - d. Existing utilities and subsurface conditions.
 - e. Coordination for interruption, shutoff, capping, and continuation of utility services.
 - f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - g. Testing and monitoring of dewatering system.
 - h. Other agenda items.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
1. Notify Architect no fewer than two days in advance of proposed interruption of utility.

2. Do not proceed with interruption of utility without Architect's, Construction Manager's, and Owner's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
 2. The geotechnical report is referenced in the Project Manual.
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Monitor dewatering systems continuously.
- E. Promptly repair damages to adjacent facilities caused by dewatering.

- F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 01 Section "Temporary Facilities and Controls" and Division 31 Section "Site Clearing" during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 1. Maintain piezometric water level a minimum of 12 inches below surface of excavation.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
 - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.
- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 FIELD QUALITY CONTROL

- A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
 3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION 312319

SECTION 312323.43 - GEOFOAM

PART 1 - GENERAL

1.1 SUMMARY

A. Sections Includes:

1. Geofoam lightweight fill for use under concrete slabs, and as void forms.
2. Geomembrane for use under slabs on grade.

B. Related Sections:

1. Section 033000 "Cast-In-Place Concrete."

1.2 REFERENCES

- A. ASTM D6817 – Standard Specification for Rigid, Cellular Polystyrene Geofoam.
- B. ASTM D7557 – Standard Guide for Sampling of Expanded Polystyrene Geofoam Specimens.
- C. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ISO 17025 – General requirements for the competence of testing and calibration laboratories.
- E. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Third Party Documents. Manufacturer literature/technical data not acceptable for submittal:

1. Third party inspection agency certificate demonstrating physical properties in compliance with ASTM D6817 Type specified.
2. Third party inspection agency certificate with flame spread and smoke developed indexes.
3. UL or ICC-ES evaluation report covering ASTM D6817 Type specified.
4. UL or ICC-ES evaluation report covering termite resistance in accordance with ICC-ES AC 239, Acceptance Criteria for Termite-Resistant Foam Plastics.

B. 10-year compressive resistance warranty.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain geofoam through one source from a single manufacturer.

B. Initial Test Compliance: Testing from an ISO17025 Accredited Laboratory showing compliance with compressive resistance at 1% deformation and flexural strength requirements of ASTM D6817 for Type specified prior to first shipment.

1. Ongoing Test Compliance: Testing from an ISO17025 Accredited Laboratory showing compliance with compressive resistance at 1% deformation of ASTM D6817 for Type specified. Testing frequency shall be in compliance with ASTM D7557.

1.5 DELIVERY, STORAGE & HANDLING

- A. Deliver geofoam labeled with ASTM D6817 Type.
- B. Store protected from moisture and sunlight prior to installation.
- C. Product should not be exposed to open flame or other ignition sources.
- D. Product should not be exposed to organic solvents, petroleum products and their vapors. Examples include but are not limited to are acetone, paint thinner, and gasoline.
- E. Provide temporary ballast or other restraint prior to and during installation.

1.6 WARRANTY

- A. Provide 10-year physical property warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer: Subject to requirements, provide products from, but not limited to, one of the following:
 1. Atlas Molded Products, A Division of Atlas Roofing.
 2. Insulfoam, A Carlisle Company.

2.2 RIGID CELLULAR POLYSTYRENE GEOFOAM

- A. Rigid Cellular Polystyrene Geofoam: ASTM D6817 Type, compressive resistance indicated below and with flame spread index less than 25 and smoke developed index less than 450 per ASTM E84/UL723.
 1. EPS15
 - a. Minimum compressive resistance at 1% deformation of 3.6 psi.
 - b. Minimum flexural strength of 25 psi.
 - c. Minimum density of 0.90 lbs per cubic foot.
 2. Size
 - a. Custom sizes as indicated on drawings
 3. Termite Resistance
 - a. Perform Guard or Perform Guard treatment

- b. Compliance with ICC-ES AC239, Acceptance Criteria for Termite- Resistant Foam Plastics.

2.3 GEOMEMBRANE

- A. Geomembrane, Reinforced or Unreinforced: Manufacture from a tri-polymer consisting of polyvinyl chloride, ethylene interpolymer alloy, and polyurethane or a comparable polymer combination. Comply with the following physical and chemical requirements, specified as minimum or maximum, not average roll properties:
 - 1. Thickness: 28 mils minimum, ASTM D 751
 - 2. Unleaded Gasoline Vapor Maximum Transmission Rate: 0.40 ounces per square foot per 24 hours ASTM D 814.
 - 3. Grab Tensile Strength: 600 pounds minimum, both machine and cross direction (1-inch grip 4-inch x 8-inch sample) ASTM D 751.
 - 4. Elongation at Break: 20 percent minimum ASTM D 751.
 - 5. Toughness: 14,000 minimum grab tensile times percent elongation. (For example: 620 pounds x 23% = 14,260.)
 - 6. Puncture Resistance: 800 pounds minimum, ASTM D 751 (ball tip).
 - 7. Cold crack, pass degrees Fahrenheit -30 ASTM D 2136 (1-inch mandrel, 4 hours).
 - 8. Factory Seams: Minimum 2 Bonded width, inches each seam.
 - 9. Shear: 320 pounds minimum, ASTM D 751 (modified per National Sanitation Foundation Std. No. 54). Fail in base geomembrane material.
 - 10. Furnish a Certificate of Compliance stating that the selected geomembrane has been tested. and it meets the above requirements, and is:
 - a. Free from pinholes, tears, and other defects which would cause leakage of liquids through the geomembrane.
 - b. Acceptable for spill containment of hydrocarbons, including automobile gasolines, aviation gas, diesel fuel, kerosene, hydraulic fluid, methanol, ethanol, mineral spirits. and naphtha.

2.4 ACCESSORIES

A. CONNECTORS

- 1. Connector Plat: Manufacturer's galvanized steel with two-sided multi-barbed design capable of piercing geofoam. Each plate shall be capable of a lateral holding strength of 60 lbs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Subgrade Preparation: For paving and slabs on grade:
 - 1. Place geomembrane over graded surface, i.e., soft soils, etc.
 - 2. Dewater as required.

3. Place a sand pad/leveling course over the prepared surface, 2 inch thickness minimum. Level to $\pm 1/2$ inch per 10 feet horizontal. Sand pad surfaces should be above ground water level at time of Foam-Control Geofoam placement.

B. Placement:

1. At time of material delivery, verify identification marks on face of the product. Use material of proper Type only and as specified. Field sampling and testing of the geofoam will be as specified by the Engineer. Properties of density and compressive resistance shall be verified in accordance with the specification.
2. Material is placed as required by the engineer and as shown on the drawings.
3. Place blocks of geofoam tightly on the prepared sand pad/leveling course (sand must not be frozen). If multiple layers of geofoam are required, orient successive layers of blocks at 90 degrees to previous layer. Offset block joints between layers.
4. Provide temporary ballast during all phases of construction to prevent displacement of geofoam wind or high water conditions.
5. Commence with the placement of permanent overlying materials as quickly as practical.
6. Use connector plates to restrain geofoam from moving laterally in layer over layer applications.
 - a. Install a minimum of four connector plates for each 4 foot by 8 foot section of geofoam.

END OF SECTION 312323

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

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 temporary excavation support and protection systems.
- B. Related Sections:
 - 1. Division 01 Section "Construction Progress Documentation and Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
 - 2. Division 01 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.
 - 3. Division 31 Section "Dewatering" for dewatering system for excavations.

1.3 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
 - 1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 4. Monitor vibrations, settlements, and movements.

1.4 SUBMITTALS

- A. Shop Drawings: For excavation support and protection system.
- B. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Coordinate first paragraph below with qualification requirements in Division 01 Section "Quality Requirements."Qualification Data: For qualified professional engineer.

D. Other Informational Submittals:

1. Photographs or Videotape: Show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.
2. Record Drawings: Identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.
 - a. Note locations and capping depth of wells and well points.

1.5 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
 - a. Geotechnical report.
 - b. Existing utilities and subsurface conditions.
 - c. Proposed excavations.
 - d. Proposed equipment.
 - e. Monitoring of excavation support and protection system.
 - f. Working area location and stability.
 - g. Coordination with waterproofing.
 - h. Abandonment or removal of excavation support and protection system.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Architect's, Construction Manager's, and Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
 1. Corners: Site-fabricated mechanical interlock or Roll-formed corner shape with continuous interlock.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.
- E. Shotcrete: Comply with Division 03 Section "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.
- F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- H. Tiebacks: Steel bars, ASTM A 722/A 722M.
- I. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate

routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

- C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

- A. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
 - 1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
 - 2. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

3.5 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
 1. Remove excavation support and protection systems to a minimum depth of **48 inches (1200 mm)** below overlaying construction and abandon remainder.
 2. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving."
 3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION 315000

SECTION 321216 - ASPHALT PAVING

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. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt paving overlay.
5. Asphalt surface treatments.
6. Pavement-marking paint.
7. Traffic-calming devices.

- B. Related Sections:

1. Division 02 Section "Structure Demolition" for demolition, removal, and recycling of existing asphalt pavements, and for geotextiles that are not embedded within courses of asphalt paving.
2. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
3. Division 32 Sections for other paving installed as part of crosswalks in asphalt pavement areas.
4. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.
5. Division 32 Section "Unit Paving" for bituminous setting bed for pavers.

1.3 UNIT PRICES

- A. Work of this Section is affected by unit prices and as defined in Division 1.

1.4 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
2. Job-Mix Designs: For each job mix proposed for the Work.
- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
- C. Samples: For each paving fabric, 12 by 12 inches minimum if used.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 1. Each paving fabric, 12 by 12 inches minimum.
 2. Each type and color of preformed traffic-calming device.
 3. Each pattern and color of imprinted asphalt and precut marking material.
- E. Qualification Data: For qualified manufacturer and Installer.
- F. Material Certificates: For each paving material, from manufacturer.
- G. Material Test Reports: For each paving material.
- H. Fire Marshal Approval: For the striping plan as it relates to fire lanes and the marking thereof.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide copy of manufacturer's experience for verification of qualifications.
- B. Installer Qualifications: Imprinted-asphalt manufacturer's authorized installer who is trained and approved for installation of imprinted asphalt required for this Project.
- C. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- D. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of city and DOT for asphalt paving work.
 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
- E. Preinstallation Conference: Conduct conference at Project site
 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review condition of subgrade and preparatory work.
 - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Prime Coat: Minimum surface temperature of 60 deg F. Not used if paving takes place within 48 hours of final grading and final compaction of road base.
 - 2. Tack Coat: Minimum surface temperature of 60 deg F.
 - 3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
 - 4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
 - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Cement: AC 20 per ASTM D 3381 for viscosity-graded material except use ductility at 39.2 deg. F., >5 for AC 20 and delete the loss on heating requirement on residue from “Thin-Film Oven Test”.
- B. Prime Coat: Not required if paving is done within 48 hours of final compaction.
- C. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- D. Fog Seal: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
- E. Water: Potable.
- F. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.
- C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- D. Joint Sealant: ASTM D 6690 or AASHTO M 324, Type I Type II or III Type IV, hot-applied, single-component, polymer-modified bituminous sealant.
- E. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N, Type F, and Type S; colors complying with FS TT-P-1952.
 - 1. Color: White, Yellow, Blue, and As indicated.
- F. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.
 - 1. Color: White, Yellow, Blue, and As indicated.
- G. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
 - 1. Color: White, Yellow, Blue, and As indicated.
- H. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
 - 1. Color: White, Yellow, Blue, and As indicated.
- I. Glass Beads: AASHTO M 247, Type 1.

- J. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch diameter, 20-inch minimum length.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located. Provide mix with the following characteristics:
 - a. Number of compaction blows each end of specimen: 50.
 - b. Stability based on ASTM D5581: 1200 minimum.
 - c. Flow in 0.01-inch units per ASTM D5581: 10-18.
 - d. Voids in mineral aggregate VMA: 14.
 - e. The percentage of bituminous material by weight added to aggregate will be between 4% and 7% of the weight of the bituminous mixture.
 - 2. Surface Course: 3-inch minimum compacted thickness and as indicated on the drawings with aggregate meeting the following gradation table

¾ inch	100
½ inch	74-99
3/8 inch	69-91
No. 4	49-65
No. 8	33-47
No. 16	21-35
No. 50	6-18
No. 200	2-6
- B. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Verify that the road base has been properly compacted and is at the correct line, grade, and slope.
- C. Verify that the road base thickness is as indicated on the project plans.
- D. Verify that sufficient depth at curbs, walks, lips and other vertical edges is available to place the required thickness of compacted asphalt.
- E. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.

2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons or other vehicle with similar axel weight.
 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- F. Proceed with paving only after unsatisfactory conditions have been corrected.
- G. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.
1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseal pieces firmly.
 2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.
1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush plus 1/8" with adjacent surface.
- E. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Not used.
- C. Prime Coat: Do not use if paving takes place not more than 48 hours after final compaction and grading of road bases. If paving must be delayed significantly, re-grade and re-compact road base or apply Prime Coat. Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 2. Protect primed substrate from damage until ready to receive paving.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings.
 3. Remove and replace items damaged by overspray or clean affected surfaces as directed by architect at no additional cost to owner.

3.5 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 1. Place hot-mix asphalt surface course in single lift if design thickness is less than 3-inches. If design thickness is more than 3-inches, place in multiple lifts with a minimum thickness of 1.5-inches and a maximum thickness of 3-inches.
 2. Spread mix at minimum temperature of 250 deg F.
 3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Place asphalt so that final compacted asphalt is even with lip of gutter on curbs that drain away from the curb and gutter (open face or depressed curb and gutter). Place asphalt so that final

compacted asphalt is 1/4-inch above lip of gutter on curbs that carry water (slope of parking lot is towards the curb). In transition areas, use extra care to make sure that no ponds, bird baths, or depressions are left after paving.

- G. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Surface Course: 1/8 inch.
 - 2. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
- C. After paving is complete, pour water on paved areas and identify ponds, bird baths, and depressions. Identify the same at open face and transition sections of curb and gutter. Remove and replace asphalt, curb and gutter, road base, and or sub-base as necessary to fix ponds, bird baths, or depressions at no additional cost to owner.

3.9 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect and approved by the local jurisdictional fire marshal.
- B. Allow paving to age for 7 days minimum days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.
- E. Color
 - 1. Yellow: Parking stalls and pedestrian crossings.
 - 2. Blue: Handicap insignia at appropriate stalls.
 - 3. Red: Fire lanes and no parking areas.
 - 4. White: Directional arrows.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726. Cores will also be measured for compacted thickness. The owner and architect may also direct additional cores to be taken at locations of their choosing to verify final pavement thickness.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
 - c. Coordinate the time and locations of all holes so that cores may be filled.
- E. The contractor will replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow milled materials to accumulate on-site.

END OF SECTION 321216

SECTION 321313 CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways and roadways.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Walkways.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
 - 2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
 - 3. Division 32 Section "Decorative Concrete Paving" for surface-imprinted, stamped finished concrete pavement.
 - 4. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Samples: 10-lb sample of exposed aggregate.
- D. Qualification Data: For manufacturer and testing agency.

- E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.
 - 7. Bonding agent or epoxy adhesive.
 - 8. Joint fillers.
- G. Field quality-control test reports.
- H. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.
 - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 3. Obtain Architect's approval of mockups before starting construction.

4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
 5. Demolish and remove approved mockups from the site when directed by Architect.
 6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete producer.
 - d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves with a radius 100 feet or less.

- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT (NO REINFORCEMENT USED FOR FLATWORK)

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- D. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.
- E. Plain Steel Wire: ASTM A 82.
- F. Deformed-Steel Wire: ASTM A 496.
- G. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- H. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- I. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- J. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement and as specified in Division 3 except that for exterior concrete, UDOT Class AA(AE) with the minimum compressive strength is 4500 psi at 28 days.
- B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using

similar aggregates and cementitious materials and the referenced projects locations and approximate quantities.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 FIBER REINFORCEMENT

- A. Synthetic Fiber: Provide fiber reinforcement in all concrete paving for vehicular traffic excluding curb and gutter. Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
1. Products:
 - a. Monofilament Fibers:
 - 1) Axim Concrete Technologies; Fibrasol IIP.
 - 2) Euclid Chemical Company (The); Fiberstrand 100.
 - 3) FORTA Corporation; Forta Mono.
 - 4) Grace, W. R. & Co.--Conn.; Grace MicroFiber.
 - 5) Metalcrete Industries; Polystrand 1000.
 - 6) SI Concrete Systems; Fibermix Stealth.
 - b. Fibrillated Fibers:
 - 1) Axim Concrete Technologies; Fibrasol F.
 - 2) FORTA Corporation; Forta.
 - 3) Euclid Chemical Company (The); Fiberstrand F.
 - 4) Grace, W. R. & Co.--Conn.; Grace Fibers.
 - 5) SI Concrete Systems; Fibermesh.

2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
 - 1. Products:
 - a. Axim Concrete Technologies; Cimfilm.
 - b. Burke by Edeco; BurkeFilm.
 - c. ChemMasters; Spray-Film.
 - d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film.
 - f. Euclid Chemical Company (The); Eucobar.
 - g. Kaufman Products, Inc.; Vapor Aid.
 - h. Lambert Corporation; Lambco Skin.
 - i. L&M Construction Chemicals, Inc.; E-Con.
 - j. MBT Protection and Repair, ChemRex Inc.; Confilm.
 - k. Meadows, W. R., Inc.; Sealtight Evapre.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
 - n. Sika Corporation, Inc.; SikaFilm.
 - o. Symons Corporation; Finishing Aid.
 - p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
 - 1. Products:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. Burke by Edoko; Aqua Resin Cure.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
 - f. Euclid Chemical Company (The); Kurez DR VOX.
 - g. Kaufman Products, Inc.; Thinilm 420.
 - h. Lambert Corporation; Aqua Kure-Clear.
 - i. L&M Construction Chemicals, Inc.; L&M Cure R.
 - j. Meadows, W. R., Inc.; 1100 Clear.
 - k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
 - l. Symons Corporation; Resi-Chem Clear.
 - m. Tamms Industries Inc.; Horncure WB 30.
 - n. Unitex; Hydro Cure 309.
 - o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
- F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.
 - 1. Products:

- a. Anti-Hydro International, Inc.; AH Curing Compound #2 WP WB.
- b. Burke by Edoco; Resin Emulsion White.
- c. ChemMasters; Safe-Cure 2000.
- d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
- e. Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).
- f. Euclid Chemical Company (The); Kurez VOX White Pigmented.
- g. Kaufman Products, Inc.; Thinfilm 450.
- h. Lambert Corporation; Aqua Kure-White.
- i. L&M Construction Chemicals, Inc.; L&M Cure R-2.
- j. Meadows, W. R., Inc.; 1200-White.
- k. Symons Corporation; Resi-Chem White.
- l. Tamms Industries, Inc.; Horncure 200-W.
- m. Unitex; Hydro White.
- n. Vexcon Chemicals, Inc.; Certi-Vex Enviocure White 100.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Color stain: Match Architect's sample or as selected by Architect from manufacturer's full range of stains.
- C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- D. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- E. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:
 1. Types I and II, non-load bearing and types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- F. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
 1. Products:
 - a. Burke by Edeco; True Etch Surface Retarder.
 - b. ChemMasters; Exposee.
 - c. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
 - d. Euclid Chemical Company (The); Surface Retarder S.
 - e. Kaufman Products, Inc.; Expose.
 - f. Metalcrete Industries; Surfard.
 - g. Nox-Crete Products Group, Kinsman Corporation; Crete-Nox TA.
 - h. Scofield, L. M. Company; Lithotex.
 - i. Sika Corporation, Inc.; Rugasol-S.

- j. Vexcon Chemicals, Inc.; Certi-Vex Envioset.
- G. Pigmented Mineral Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
 - 1. Products:
 - a. Conspec Marketing & Manufacturing Co., Inc.; Conshake 600 Colortone.
 - b. Dayton Superior Corporation; Quartz Tuff.
 - c. Euclid Chemical Company (The); Surfex.
 - d. Lambert Corporation; Colorhard.
 - e. L&M Construction Chemicals, Inc.; Quartz Plate FF.
 - f. MBT Protection and Repair, ChemRex Inc.; Mastercron.
 - g. Metalcrete Industries; Floor Quartz.
 - h. Scofield, L. M. Company; Lithochrome Color Hardener.
 - i. Symons Corporation; Hard Top.
 - 2. Color: Match Architect's sample or as selected by Architect from manufacturer's full range.
- H. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.
- I. Sealer: Apply Euco – Guard 100 Weatherproofing Siloxane Sealer or Engineer Approved Equal Sealant to all concrete pavement and pedestrian walks on the site.

2.8 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or II or AASHTO M 248, Type N or F.
 - 1. Color: White, Yellow, Blue, Black. See Section 321216 for color locations.
- B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
 - 1. Color: White, Yellow, Blue, Black. See Section 321216 for color locations.
- C. Glass Beads: AASHTO M 247, Type 1.
- D. All striping on concrete pavement shall be underlaid by a black stripe of equal dimensions plus one inch on all sides.

2.9 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4500 psi
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45
 - 3. Select slump limit from options in subparagraph below or revise to suit Project.
 - 4. Slump Limit: 4 inches, plus or minus 1 inch.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 5-8 percent nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture, high-range, water-reducing admixture, high-range, water-reducing and retarding admixture, plasticizing, and retarding admixture in concrete, as required, for placement and workability.
 - 2. Specify admixtures as part of submittal. Verify that admixtures proposed do not adversely effect stained concrete and will not modify colors of stain.
 - 3. Coordinate acceptability of admixtures with architect.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements as follows:
 - 1. Fly Ash or Pozzolan: 25 percent.
 - 2. Ground Granulated Blast-Furnace Slag: 50 percent.
 - 3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- G. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. where specified and approved in mix submittal.
- H. Color Stain: Add stain to concrete per manufacturers recommendations and to meet color required by architect and owner on areas of stained concrete.

2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete mixes larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons or similar axel weight vehicle.
 3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
 - 2. All joints to be sealed and protected within 15 days of their initial construction. The contractor shall protect the joints during the 15 days prior to sealing from weather and damage.
 - 3. Expansion joints shall be constructed at intervals of no more than 60' on center with a 1/2" expansion joint filler at each end of that distance.
 - 4. Control joints shall be constructed at intervals of no greater than 24 times the pavement thickness and in no case greater than the width of the concrete pavement.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 - 2. Provide tie bars at sides of pavement strips where indicated.
 - 3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 5. 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.

- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. Locate expansion joints at intervals shown on the jointing plan or as directed by the Architect, unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 3. Doweled Contraction 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.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

- E. Do not add water to concrete during delivery or at Project site.
- F. Do not add water to fresh concrete after testing.
- G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
 - 1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.
- J. Concrete placements for site paving shall be performed in increments of no more than 50 cubic yards per day unless the contractor can demonstrate by prior placements that they have both sufficient personnel and equipment to achieve satisfactory results in spite of local conditions and weather.
- K. Screed pavement surfaces with a straightedge and strike off
- L. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- M. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- N. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- O. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

- P. 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 air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- Q. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to 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. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
- R. Placement of concrete paving shall not exceed 250 Cubic Yards per day without prior approval from the Architect and Engineer. The contractor shall notify the Architect 48 hours prior to any placement of concrete pavement of over 100 Cubic Yards.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
 4. Coordinate with architect the locations of each type of finish.

3.8 SPECIAL FINISHES

- A. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to pavement surface according to manufacturer's written instructions and as follows:
 - 1. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match pavement color required.
 - 2. Uniformly distribute approximately two-thirds of dry-shake hardener over pavement surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second dry-shake hardener application, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed by power floating.
 - 3. After final floating, apply a hand-trowel finish followed by a broom finish to concrete.
 - 4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.
- B. Coordinate the locations of finishes with the architect and owner prior to placing concrete.

3.9 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to 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.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - 1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. 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.

3.10 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 - 1. Elevation: 1/4 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot-long, unlevelled straightedge not to exceed 1/4 inch.
 - 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 - 5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
 - 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
 - 8. Joint Spacing: 3 inches.
 - 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 10. Joint Width: Plus 1/8 inch, no minus.

3.11 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow concrete pavement to cure for 14 days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Spread glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: 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 at least 1 composite sample for each 100 cu. yd. or 5000 sq. ft. or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 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.
- D. 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.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. 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.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Expansion and contraction joints within cement concrete pavement.
 - 2. Joints between cement concrete and asphalt pavement.
- B. Related Sections include the following:
 - 1. Division 07 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
 - 2. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
 - 3. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- D. Qualification Data: For installer and testing agency.
- E. Compatibility and Adhesion Test Reports: 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 needed for adhesion.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit not fewer than six (6) pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT 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.
 - 2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 3. When joint substrates are wet or covered with frost.
 - 4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, 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 COLD-APPLIED JOINT SEALANTS

- A. Multi-component Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:
 - 1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.
 - a. Available Products:
 - 1) Pecora Corporation; Urexpan NR-300.
 - 2) Engineer approved equal.
 - 2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.
 - a. Available Products:
 - 1) Meadows, W. R., Inc.; Sealtight Gardox.
 - 2) Engineer Approved Equal.
 - 3. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
 - a. Available Products:
 - 1) Tremco Sealant/Waterproofing Division; Vulkem 202.
 - 2) Engineer approved Equal.

- B. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
 - 1. Available Products:
 - a. Sonneborn, Div. of ChemRex, Inc.; Sonomeric 1.
 - b. Engineer Approved Equal.

- C. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
 - 1. Available Products:
 - a. Crafcro Inc.; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.
 - c. Engineer Approved Equal.

- D. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
 - 1. Available Products:
 - a. Crafcro Inc.; RoadSaver Silicone SL.
 - b. Dow Corning Corporation; 890-SL.
 - c. Engineer Approved Equal.

- E. Multi-component Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.
 - 1. Available Products:
 - a. Meadows, W. R., Inc.; Sof-Seal.
 - b. Engineer Approved Equal.

2.4 HOT-APPLIED JOINT SEALANTS

- A. Jet-Fuel-Resistant Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3569.
 - 1. Available Products:
 - a. Crafcro Inc.; Superseal 444/777.
 - b. Meadows, W. R., Inc.; Poly-Jet 3569.
 - c. Engineer Approved Equal.

- B. Jet-Fuel-Resistant Sealant for Concrete and Tar Concrete: Single-component formulation complying with ASTM D 3581.
 - 1. Available Products:
 - a. Crafcro Inc.; Superseal 1614A.

- b. Meadows, W. R., Inc.; Poly-Jet 1614.
- c. Meadows, W. R., Inc.; Poly-Jet 3406.
- d. Meadows, W. R., Inc.; Poly-Jet 3569.
- e. Engineer Approved Equal.

C. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

1. Available Products:

- a. Crafcoc Inc.; Superseal 444/777.
- b. Meadows, W. R., Inc.; Poly-Jet 3406.
- c. Engineer Approved Equal.

D. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

1. Available Products:

- a. Koch Materials Company; Product No. 9005.
- b. Koch Materials Company; Product No. 9030.
- c. Meadows, W. R., Inc.; Sealtight Hi-Spec.
- d. Engineer Approved Equal.

2.5 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
- D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.6 PRIMERS

- A. Primers: Product 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.

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 joint-sealant performance.
 - 1. 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.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials 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 backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

3.6 DOCUMENTATION

A. The contractor shall keep a daily log of all joints sealed in graphical format. This shall be submitted to the Architect on a weekly basis.

END OF SECTION 321373

SECTION 321816.13 - PLAYGROUND PROTECTIVE 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. Unitary, seamless surfacing.

1.3 DEFINITIONS

- A. Definitions in ASTM F2223 apply to Work of this Section.
- B. Critical Height: Standard measure of shock attenuation according to ASTM F2223; same as "critical fall height" in ASTM F1292. According to ASTM F1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."
- C. SBR: Styrene-butadiene rubber.
- D. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F2223.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of protective surfacing.
 - 1. Include plans, sections, placement and penetration details, and attachment to substrates.
 - 2. Include accessories and edge terminations.
 - 3. Include patterns made by varying colors of surfacing and details of graphics.
 - 4. Include fall heights and use zones for equipment and structures specified in Section 116800 "Play Field Equipment and Structures," coordinated with the critical heights for protective surfacing.
- C. Samples for Initial Selection: For each type of exposed finish.
 - 1. Include Samples of accessories involving color selection.
- D. Samples for Verification: For each type of protective surfacing and exposed finish.
 - 1. Include Samples of accessories to verify color and finish selection.

2. Unitary, Seamless Surfacing: Minimum 6 by 6 inches (150 by 150 mm).
3. Drainage/Separation Geotextile: Minimum 12 by 12 inches (300 by 300 mm).
4. Drainage Panel: Minimum 6 by 6 inches (150 by 150 mm).
5. Weed-Control Barrier: Minimum 12 by 12 inches (300 by 300 mm).

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each type of loose-fill surfacing.
- C. Product Certificates: For each type of unitary surfacing product.
- D. Field quality-control reports.
- E. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for materials and execution.
 1. Build mockups for protective surfacing including accessories.
 - a. Size: 48 inches (1200 mm) by 48 inches (1200 mm).
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Reduction in impact attenuation as measured by reduction of critical fall height.
 - b. Deterioration of protective surfacing and other materials beyond normal weathering.
 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain protective surfacing materials, including loose-fill accessories, from single source from single manufacturer.
 - 1. Provide geosynthetic accessories of each type from source recommended by manufacturer of protective surfacing materials.

2.2 PERFORMANCE REQUIREMENTS

- A. Impact Attenuation: Critical fall height tested according to ASTM F1292.
- B. Accessibility Standard: Minimum surfacing performance according to ASTM F1951.

2.3 UNITARY, SINGLE-DENSITY, SEAMLESS SURFACING

- A. Description: Manufacturer's standard, site-mixed and applied, single-layer material in thickness as required, tested for impact attenuation according to ASTM F1292 and for accessibility according to ASTM F1951.
 - 1. Composition: Blend of recycled SBR and EPDM rubber, particles and binder, forming a wearing and cushioning product.
 - 2. Binder: Weather-resistant, UV-stabilized, flexible, nonhardening, 100 percent solids polyurethane.
 - 3. Critical Height: As indicated on Drawings.
 - 4. Overall Thickness: Not less than as required for critical height indicated.
 - 5. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location.
 - 6. Color(s): As selected by Architect from manufacturer's full range.
- B. Leveling and Patching Material: Portland cement-based grout or epoxy- or polyurethane-based formulation suitable for exterior use and approved by protective surfacing manufacturer.

2.4 UNITARY, DUAL-DENSITY, SEAMLESS SURFACING

- A. Description: Manufacturer's standard, site-mixed and applied, two-layer material with wearing layer over cushioning layer, with combined, overall thickness as required, tested for impact attenuation according to ASTM F1292 and for accessibility according to ASTM F1951.
 - 1. Wearing Layer: Formulation of EPDM rubber particles or polyurethane granules, binder, and other organic and inorganic components.
 - 2. Cushioning Layer: Formulation of recycled SBR particles and binder.
 - 3. Binder: Weather-resistant, UV-stabilized, flexible, nonhardening, 100 percent solids polyurethane.
 - 4. Lacquer Topcoat: Manufacturer's standard polyurethane-based formulation.
 - 5. Critical Height: As indicated on Drawings.
 - 6. Overall Thickness: Not less than as required for critical height indicated.
 - 7. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location.
 - 8. Wearing Layer Color(s): As selected by Architect from manufacturer's full range.

- a. Design: Where colored pattern is required, provide as indicated on Drawings.
- B. Leveling and Patching Material: Portland cement-based grout or epoxy- or polyurethane-based formulation suitable for exterior use and approved by protective surfacing manufacturer.
- C. Leveling and Patching Material: Portland cement-based grout or epoxy- or polyurethane-based formulation suitable for exterior use and approved by protective surfacing manufacturer.

2.5 GEOSYNTHETIC ACCESSORIES

- A. Drainage/Separation Geotextiles: Comply with Section 312000 "Earth Moving."
- B. Drainage/Separation Geotextile: Nonwoven, needle-punched geotextile, manufactured for drainage applications and made from polyolefins or polyesters; with the following minimum properties:
 - 1. Weight: 4 oz./sq. yd. (136 g/sq. m); ASTM D5261.
 - 2. Water Flow Rate: 100 gpm/sq. ft. (68 L/s per sq. m) according to ASTM D4491.
- C. Weed-Control Barrier: Composite fabric geotextile consisting of woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, weighing not less than 4.8 oz./sq. yd. (160 g/sq. m).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
- B. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary, protective surfacing installation and that substrate surfaces are dry, cured, and uniformly level sloped to drain within recommended tolerances according to protective surfacing manufacturer's written requirements for cross-section profile.
 - 1. Concrete Substrates: Verify that substrates are dry and free from surface defects, laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by protective surfacing manufacturer.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.

- B. Hard-Surface Substrates: Clean surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with protective surfacing.
 - 1. Repair: Fill holes and depressions in unsatisfactory surfaces with leveling and patching material.
 - 2. Treatment: Mechanically abrade or otherwise prepare concrete substrates according to protective surfacing manufacturer's written instructions to achieve adequate roughness.
 - 3. Terminal Edges: Saw cut concrete for terminal edges of protective surfacing.
 - 4. Treat control joints and other nonmoving substrate cracks to prevent telegraphing through protective surfacing.

3.3 INSTALLATION OF GEOSYNTHETIC ACCESSORIES

- A. Install geosynthetic accessories before edging and according to playground surface system manufacturer's and geosynthetic manufacturer's written instructions and in a manner that cannot become a tripping hazard.
 - 1. Drainage/Separation Geotextile: Completely cover area beneath protective surfacing, overlapping geotextile sides and edges a minimum of **8 inches (200 mm)** with manufacturer's standard treatment for seams.
 - 2. Weed-Control Barrier: Completely cover area beneath loose-fill installation, overlapping barrier edges a minimum of **8 inches (200 mm)** with manufacturer's standard treatment for seams.

3.4 INSTALLATION OF SEAMLESS SURFACING

- A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.
 - 1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
 - 2. Poured Cushioning Layer: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
 - 3. Intercoat Primer: Over cured cushioning layer, apply primer at manufacturer's standard spreading rate.
 - 4. Wearing Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
 - a. Design: Where colored pattern is required, place colored, design material as soon as previously placed material is sufficiently cured, using primer or adhesive if required by manufacturer's written instructions.
 - 5. Lacquer Topcoat: Spray or roller applied at manufacturer's standard coating rate in one continuous operation.
 - 6. Edge Treatment: Flush. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with performance requirements.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests with the assistance of a factory-authorized service representative:
 - 1. Perform "Installed Surface Performance Test" according to ASTM F1292 for each protective surfacing type and thickness in each playground area.
 - 2. Perform installed-surface-performance tests at no less than one series of tests for each **1000 sq. ft. (100 sq. m)** of each type and thickness of in-place protective surfacing or part thereof.
- B. Playground protective surfacing will be considered defective if it does not pass tests.
- C. Prepare test reports.

3.6 PROTECTION

- A. Prevent traffic over seamless surfacing for not less than 48 hours after installation.

END OF SECTION 321816.13

SECTION 321818 - SYNTHETIC GRASS PLAYGROUND SURFACING (BID ALTERNATE #4)

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. Furnish all labor, materials, tools and equipment necessary for the complete installation of a playground protective synthetic grass surfacing system that meets the requirements of ASTM F 1292-09 and IPEMA Certification of conformance as a safe public play surface as indicated on the plans and as specified herein; including components and accessories required for a complete installation, including but not limited to:
 - 1. Acceptance of prepared sub-base.
 - 2. Coordination with related trades to ensure a complete, integrated, and timely installation: aggregate base course, sub-base material (tested for permeability), grading and compacting, piping and drain components (when required); as provided under its respective trade section.
- B. Related Requirements:
 - 1. Section 312000 "Earth Moving" for preparation, compaction, and grading of granular base.

1.3 REFERENCE STANDARDS

- A. ASTM – American Society for Testing and Materials.
 - 1. D1577 - Standard Test Method for Linear Density of Textile Fiber.
 - 2. D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering.
 - 3. D1338 - Standard Test Method for Tuft Bind of Pile Yarn Floor Covering.
 - 4. D1682 - Standard Method of Test for Breaking Load and Elongation of Textile Fabrics.
 - 5. D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test).
 - 6. D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - 7. F1292-09 - Standard Test Method for Impact Attenuation or Critical Fall Height of Surfacing Materials Under and Around Playground Equipment.
 - 8. D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.
- B. IPEMA – International Play Equipment Manufacturers Association
 - 1. Public Play Surfacing Certified to ASTM F1292-09 - Standard Test Method for Impact Attenuation or Critical Fall Height of Surfacing Materials Under and Around Playground Equipment.

1.4 PERFORMANCE REQUIREMENTS

- A. Completed playground protective synthetic grass surfacing system shall be capable of meeting the following performance requirements:
1. IPEMA Public Play Surfacing Certified
 2. ASTM F1292-09: Impact attenuation. Playground protective surface shall meet performance requirements for the impact attenuation of playground surfacing materials installed within the use zone of playground equipment, as specified by Architect.
 3. ASTM D4491: Water permeability test. Synthetic grass surface shall drain at a rate of 300 inches or more, of water per hour.
 4. ASTM D1338: Tuft bind. Synthetic grass surfacing shall have a tuft bind, without infill material of 8 pounds or more.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at project site at time to be determined by Architect. Review methods and procedures related to installation including, but not limited to, the following:
1. Inspect and discuss existing conditions and preparatory work performed under other contracts.
 2. In addition to the Contractor and the installer, arrange for the attendance of installers affected by the Work, The Owner's representative, and the Architect.

1.6 ACTION SUBMITTALS

- A. Substitutions: Other products are acceptable if in compliance with all requirements of these specifications. Submit alternate products to Architect for approval prior to bidding in accordance Product Substitution Procedures.
1. Provide substantiation that proposed system does not violate any other manufacturer's patents, patents allowed or patents pending.
 2. Provide a sample copy of insured, non-prorated warranty and insurance policy information.
- B. Product Data: For each type of product.
1. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications; preparation and installation instructions and recommendations.
 2. Submit fiber manufacturer's name, type of fiber and composition of fiber.
 3. Submit shock absorbing pad manufacturer's name.
 4. Submit data in sufficient detail to indicate compliance with the contract documents.
 5. Submit manufacturer's instructions for installation.
 6. Submit manufacturer's IPEMA Certificate to indicate compliance with certified public play surfacing.
- C. Shop Drawings: For synthetic grass surfacing.
1. Include sections and details.
 2. Show locations of seams and method of seaming.
- D. Samples: For each type of synthetic grass surfacing indicated.

1. Turf Fabric: 12 inches square.
2. Infill Material: 4 oz. of each type.
3. Shock-Attenuation Pad: 12 inches square.
4. Seam Sample: 24 inches square with seam centered in sample.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer testing agency.
- B. Product Test Reports: For each synthetic grass surfacing assembly.
 1. Pile Height, Face Weight & Total Fabric Weight, ASTM D5848.
 2. Primary & Secondary Backing Weights, ASTM D5848.
 3. Tuft Bind, ASTM D1335.
 4. Grab Tear Strength, ASTM D1682 or D5034.
 5. Water Permeability, ASTM D4491
 6. Artificial turf fiber proposed for the field(s) must have successfully undergone a minimum of 200,000 cycles on the Lisport wear test. This fiber must be exactly the same fiber that is being proposed for the field(s). Official report must be provided.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For synthetic grass surfacing, including maintenance cleaning instructions, to include in maintenance manuals.

1.9 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. Turf Fabric: Minimum of 300 sq. ft. for each type indicated.
 2. Infill: Minimum of 1 bags of each type.
 3. Seaming Tape and Adhesive: One roll of seaming tape and one gallon of adhesive.
 4. One new set of maintenance tools, of type recommended by synthetic grass surfacing manufacturer for installation.

1.10 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engaged in manufacturing synthetic grass surfacing products for a minimum of ten (10) years.
 1. The Manufacturer shall be experienced in the manufacturing and installation of specified type of playground protective synthetic grass surfacing system. This includes use of a dual polymer monofilament fiber, slit-film fiber and texturized monofilament fiber, backing, the backing coating, shock absorbing playground pad and the installation method.
 2. The Manufacturer shall own and operate its own manufacturing plant. Manufacturing the fiber, tufting of the fibers into the backing materials and coating of the synthetic grass system must be done in-house by manufacturer.

3. The Manufacturer must hold ISO 9001, ISO 14001 and ISO 45001 certifications demonstrating its manufacturing efficiency with regards to quality, environment and safety management systems.
 4. The Manufacturer must hold IPEMA certification for specified synthetic grass product.
- B. Installer/Contractor Qualifications: Company shall specialize in performing the work of this section.
1. The Company shall provide competent workmen skilled in this specified type of playground protective synthetic grass system installation.
 2. The designated Supervisory Personnel on the project shall be certified, in writing by the manufacturer, as competent in the installation of specified type of synthetic grass system, including gluing seams and proper installation of the shock absorbing playground pad and infill material.
 3. The Company shall be certified by the manufacturer and licensed (if required).
- C. The Installer/Contractor shall verify special conditions required for the installation of the playground protective synthetic grass system.
- D. The Installer/Contractor shall notify the Architect of any discrepancies.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store components with labels intact and legible.
- B. Store materials in location and manner to allow installation of synthetic grass surfacing without excess disturbance of granular base.
- C. Store materials/components in a secure manner, under cover and elevated above grade.
- D. Protect from damage during storage, handling and installation. Protect from damage by other trades.
- E. Inspect all delivered materials and products to ensure they are undamaged and in good condition.

1.12 WARRANTY

- A. The Contractor shall provide a warranty to the Owner that covers defects in materials and workmanship of the turf for a period of fifteen (15) years from the date of substantial completion. The turf manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements. The manufacturer's warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of God beyond the control of the Owner or the manufacturer. The warranty shall be fully third party insured; pre paid for the entire 15 year term and be non-prorated. The Contractor shall provide a warranty to the Owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the manufacturer's recommendations and any written directives of the manufacturer's representative. Prior to final payment for the synthetic turf, the Contractor shall submit to owner notification in writing that the field is officially added to the annual policy coverage, guaranteeing the warranty to the Owner. The insurance policy must be underwritten by an "AM Best" A rated carrier and must reflect the following values:

1. Pre-Paid 10-year insured warranty from a single source.
 2. Maximum per claim coverage amount of \$33,000,000
 3. Minimum of thirty-three million dollars (\$33,000,000) annual.
 4. Must cover full 100% replacement value of total square footage installed, minimum of \$7.00 per sq ft. (in case of complete product failure, which will include removal and disposal of the existing surface)
 5. Provide a sample copy of insured, non-prorated warranty and insurance policy information.
 6. Policy cannot include any form of deductible to be paid by the Owner.
- B. Special Warranty: Manufacturer agrees to repair or replace synthetic grass surfacing that fails in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Deterioration and excessive wear.
 - b. Deterioration from UV light.
 - c. Excessive loss of shock attenuation.
 - d. Seam separation.
 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Playground Protective Synthetic Grass Surfacing system shall consist of the following:
1. Synthetic grass surfacing made with a combination of dual polymer monofilament fibers, slit-film fibers and texturized monofilament fibers, tufted into a fibrous, perforated and porous backing.
 2. Shock absorbing playground pad.
 3. Anchoring device to secure perimeter edge of synthetic grass.
 4. Infill: Graded dust-free silica sand that partially covers the synthetic grass. Graded dust-free acrylic coated silica sand may be substituted for silica sand as requested by Architect.
 5. Glue, thread, seaming fabric and other materials used to install and mark the synthetic grass.
- B. Synthetic grass surfacing system shall have the following properties:

Standard	Property	Specification
ASTM D1577	Fiber Denier A	14000
ASTM D1577	Fiber Denier B	10000+
ASTM D1577	Fiber Denier C	5000+
ASTM D5823	Pile Height	1.625"

ASTM D5793	Stitch Gauge	3/8"
ASTM D5848	Pile Weight	65 oz/square yard
ASTM D5848	Primary Backing	>9oz/square yard
ASTM D5848	Secondary Backing	>21 oz/square yard
ASTM D5848	Total Weight	>94 oz/square yard
ASTM D1338	Tuft Bind (Without Infill)	8lbs
ASTM D4491	Turf Permeability	300 inches/hour
N/A	Infill Component	3 lbs/square foot

Variation of +/- 5% on above listed property values is within normal manufacturing tolerances

- C. Turf Fabric: Woven turf fabric with multicolored fiber and UV resistance, complying with the following:
 - 1. Turf fabric tested according to the following methods, with additional test method conditions for each method according to ASTM F 1551.
 - 2. Tuft Bind: Not less than 8 lbf according to ASTM D 1335.
 - 3. Breaking Strength: Minimum 200 lbf in warp direction and minimum 200 lbf perpendicular to warp direction, according to ASTM D 5034.

- D. Synthetic Grass Surfacing: Assembly tested according to the following methods, with additional test method conditions for each method according to ASTM F 1551.
 - 1. Shock Attenuation: No greater than 160 G(max) at time of installation according to ASTM F 355.

- E. Permeability: 6-9 in./h of rainfall capacity according to ASTM F 2898 or EN 15330-1.

- F. Durability: Minimum of 30,000 wear cycles according to EN 15306 (Lisport test).

- G. Synthetic grass surfacing product shall consist of dual polymer monofilament fibers, slit-film fibers and texturized monofilament fibers tufted into a primary backing with a secondary backing.
 - 1. Lead Content of Yarn Fiber: Maximum of 100 ppm according to ASTM F 2765.

- H. Backing:

1. Primary backing shall be a triple-layered polypropylene fabric.
 2. Secondary backing shall consist of an application of porous urethane to permanently lock the fiber tufts in place.
 3. Perforated (with punched holes), backed turf is acceptable.
 4. Turf with attached scrim in lieu of porous urethane is unacceptable.
- I. Primary fiber shall be 14,000 denier, low friction, and UV-resistant fiber measuring not less than 1.625 inches high. Secondary fiber shall be +10,000 denier. Third fiber shall be +5,000 denier.
- J. Shock absorbing playground pad shall drain vertically and laterally without absorbing water or other liquids. Shock absorbing pad in 2"+ and a Double Layer of 2"+ pad measuring a total of 4"+ to meet specified use zone critical fall height requirements as requested by Architect.
- K. Infill materials shall be approved by the manufacturer.
1. Infill shall consist of graded dust-free sand. Graded dust-free acrylic coated silica sand may be substituted for silica sand as requested by Architect.
- L. Glue and seaming fabric, for seaming of synthetic grass shall be as recommended by the synthetic grass manufacturer.

2.2 SYNTHETIC GRASS SURFACING

- A. Synthetic Grass Surfacing: Complete surfacing system, consisting of synthetic yarns bound to water-permeable backing and infill indicated, suitable for Playground surfacing.
1. Manufacturers: The Basis of Design for the project is Command Core manufactured by Field Turf. 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. A-Turf Inc.; an ECORE company.
 - b. AstroTurf; a SportGroup company.
 - c. FieldTurf, a Tarkett Sports Company.
 - d. Rocky Mountain Turf.
 - e. Shaw Sports Turf Division of Berkshire Hathaway.
 - f. Sporturf; Controlled Products, LLC.
 - g. Sprinturf; Specialty Surfaces International.

2.3 MATERIALS

- A. Seam Adhesive: One or two-part urethane, recommended or approved by synthetic grass surfacing manufacturer, and suitable for ambient conditions at time of installation.
- B. Seam Tape: Synthetic grass manufacturer's recommended seam tape, minimum 12 inches wide, 18 inches wide for inlaid game lines.
- C. Shock-Attenuation Pad: Porous composite consisting of rubber granules bound with urethane adhesive, As required mm thick; nondimpled . Provide shock-attenuation pad with permeability sufficient to meet synthetic grass surfacing assembly permeability indicated.

2.4 QUALITY CONTROL IN MANUFACTURING

- A. The manufacturer shall own and operate its own manufacturing plant in. Both tufting of the fibers into the backing materials and coating of the turf system must be done in-house by the synthetic grass manufacturer. Outsourcing of either is unacceptable.
- B. The manufacturer shall have full-time certified in-house inspectors at their manufacturing plant that are experts with industry standards.
- C. The manufacturer's full-time in-house certified inspectors shall perform pre-tufting fiber testing on tensile strength, elongation, tenacity, and denier, upon receipt of fiber spools from fiber manufacturer.
- D. Primary backing shall be inspected by the manufacturer's full-time certified in-house inspectors before tufting begins.
- E. The manufacturer's full-time in-house certified inspectors shall verify "pick count", yarn density in relation to the backing, to ensure the accurate amount of face yarn per square inch.
- F. The manufacturer's full-time, in-house, certified inspectors shall perform product inspections at all levels of production including during the tufting process and at the final stages before the synthetic grass is loaded onto the truck for delivery.
- G. The manufacturer shall have its own, in-house laboratory where samples of synthetic grass are retained and analyzed, based on standard industry tests, performed by full-time, in-house, certified inspectors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine base and other conditions, with Installer present, for compliance with requirements for installation tolerances, permeability, and other conditions affecting performance of the Work.
- B. Verify that all sub-base leveling is complete prior to installation.
- C. Installer/Contractor shall examine the surface to receive the synthetic grass, the shock absorbing playground pad, and accept the sub-base planarity in writing prior to the beginning of installation.
 - 1. Acceptance is dependent upon the Owner's test results indicating compaction and planarity are in compliance with manufacturer's specifications.
 - 2. The surface shall be accepted by Installer as "clean" as installation commences and shall be maintained in that condition throughout the process.
- D. Compaction of the aggregate base shall be 90%, in accordance with ASTM D1557 (Modified Proctor procedure); and the surface tolerance shall not exceed 0-1/4 inch over 10 feet and 0-1/2 inch from design grade.
- E. Correct conditions detrimental to timely and proper completion of Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prior to the beginning of installation, inspect the sub-base for tolerance to grade.
- B. Sub-base acceptance shall be subject to receipt of test results (by others) for compaction and planarity that sub-base is in compliance with manufacturer's specifications and recommendations.
- C. When requested by Architect, installed sub-base shall be tested for porosity prior to the installation of the synthetic grass system. A sub base that drains poorly is an unacceptable substrate.

3.3 INSTALLATION

- A. Avoid disturbance of base during installation of shock-attenuation pad and turf fabric.
- B. Shock absorbing playground pad shall be installed directly over the properly prepared aggregate base. Extreme care shall be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity.
 - 1. Repair and properly compact any disturbed areas of the aggregate base as recommended by manufacturer.
 - 2. Roll out pad and allow to relax a minimum of six hours prior to final fit and trim.
 - 3. Stagger head seams between adjacent rows.
 - 4. Seams shall be flat, tight, and permanent with no separation or fraying
- C. Playground protective synthetic grass system shall be installed directly over the shock absorbing playground pad.
 - 1. Roll out turf fabric and allow to relax at least four hours prior to seaming.
 - 2. Seams shall be flat, tight, and permanent with no separation or fraying.
 - 3. Remove yarns that are trapped within seams.
 - 4. Attach turf fabric to perimeter restraint system as recommended by the manufacturer.
- D. Repair loose seams and bubbles formed due to expansion of turf fabric prior to installation of infill.
- E. Infill Materials:
 - 1. Infill materials shall be applied in thin lifts. The turf shall be brushed as the material is applied. The infill material shall be installed to a depth determined by the manufacturer.
 - 2. Infill material shall be installed in a systematic order.
 - 3. Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The Infill installation consists of graded dust-free silica sand. Graded dust-free acrylic coated silica sand may be substituted for silica sand as requested by Architect.
 - 4. The Installer/Contractor shall keep area clean throughout the project and clear of debris. Upon completion of installation, the finished project shall be inspected by the installation crew and an installation supervisor.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

3.5 ADJUSTMENT AND CLEANING

- A. Do not permit traffic over unprotected surface.
- B. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.
- C. All usable remnants of new material shall become the property of the Owner.
- D. The Contractor shall keep the area clean throughout the project and clear of debris.
- E. Surfaces, recesses, enclosures, and related spaces shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.
- F. Protect completed playground protective synthetic grass surfacing system throughout construction process until project completed.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel in proper maintenance procedures for synthetic grass surfacing.

END OF SECTION 321813

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

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. Decorative metallic-coated-steel tubular picket fences.
 - 2. Swing gates.
 - 3. Horizontal-slide gates.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fencing and gates.
 - 1. Include plans, elevations, sections, gate locations, post spacing, and mounting details.

1.5 INFORMATIONAL SUBMITTALS

1.6 CLOSEOUT SUBMITTALS

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind Loading:

1. Fence Height: 0 to 15 feet .
2. Wind Exposure Category: B .
3. Design Wind Speed: 120 mph .

2.2 DECORATIVE METALLIC-COATED-STEEL TUBULAR PICKET FENCES

- A. Decorative Metallic-Coated-Steel Tubular Picket Fences: Comply with ASTM F 2408 for light-industrial (commercial) application (class) unless otherwise indicated.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Ameristar Fence Products; an ASSA ABLOY company; Montage II - Majestic or comparable product by one of the following:
 - a. Iron World Manufacturing, LLC.
 - b. Master Halco.
 - c. Ameristar Fence Products; an ASSA ABLOY company.
- B. Posts:
1. End and Corner Posts: Square tubes 3 by 3 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 2. Posts at Swing Gate Openings: Square tubes 3 by 3 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 3. Posts at Swing Gate Openings: Square steel tubing 4 by 4 inches with 3/16-inch wall thickness, hot-dip galvanized.
 4. Posts at Horizontal-Slide Gate Openings up to 12 Feet: Square steel tubing 4 by 4 inches with 3/16-inch wall thickness, hot-dip galvanized.
 5. Posts at Horizontal-Slide Gate Openings Wider Than 12 Feet: Square steel tubing 4 by 4 inches with 3/16-inch wall thickness, hot-dip galvanized.
- C. Post Caps: Formed from steel sheet and hot-dip galvanized after forming .
- D. Rails: Square tubes .
1. Size: 1-3/4 by 1-3/4 inches.
 2. Metal and Thickness: 0.079-inch nominal-thickness, metallic-coated steel sheet or 0.075-inch nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
- E. Pickets: Square tubes.
1. Terminate tops of pickets at top rail for flush top appearance .
 2. Picket Spacing: 4 inches clear, maximum.
- F. Fasteners: Manufacturer's standard concealed fastening system.
- G. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc, alloy-coated steel sheet.
- H. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior .

- I. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified in ASTM F 2408, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- J. Finish: Powder coating.

2.3 SWING GATES

- A. Gate Configuration: As indicated.
- B. Gate Frame Height: 6'-0" .
- C. Gate Opening Width: 4'-0" .
- D. Automated vehicular gates shall comply with ASTM F 2200, Class III .
- E. Steel Frames and Bracing: Fabricate members from square steel tubing 1-1/2 by 1-1/2 inches with 1/8-inch wall thickness. Hot-dip galvanize frames after fabrication.
- F. Frame Corner Construction: Welded .
- G. Additional Rails: Provide as indicated, complying with requirements for fence rails.
- H. Infill: Comply with requirements for adjacent fence.
- I. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
- J. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide cane bolts for pairs of gates.
 - 1. .
- K. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.
 - 1. Function: 39 - Full surface, triple weight, antifriction bearing.
 - 2. Material: Wrought steel, forged steel, cast steel, or malleable iron; galvanized.
- L. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 3/4-inch- diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.
- M. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay .
- N. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- O. Metallic-Coated-Steel Finish: High-performance coating .
- P. Steel Finish: Primed High-performance coating.

2.4 HORIZONTAL-SLIDE GATES

- A. Gate Configuration: As indicated.
 - 1. Type: Cantilever slide, with external roller assemblies.
- B. Gate Frame Height: 72 inches .
- C. Gate Opening Width: .
- D. Automated vehicular gates shall comply with ASTM F 2200, Class IV.
- E. Galvanized-Steel Frames and Bracing: Fabricate members from square tubing.
 - 1. Frame Members: Square tubes 1-3/4 by 1-3/4 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - 2. Bracing Members: Square tubes 1-3/4 by 1-3/4 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
- F. Frame Corner Construction:
 - 1. Welded frame and 5/16-inch- diameter, adjustable truss rods for panels 5 feet wide or wider.
- G. Additional Rails: Provide as indicated, complying with requirements for fence rails.
- H. Infill: Comply with requirements for adjacent fence.
- I. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
 - 1. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence .
- J. Hardware: Latches permitting operation from both sides of gate, locking devices hangers roller assemblies and stops fabricated from galvanized steel . Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
- K. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay .
- L. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- M. Metallic-Coated-Steel Finish: High-performance coating .
- N. Steel Finish: High-performance coating.
- O. Aluminum Finish: Baked enamel or powder coating.

2.5 STEEL AND IRON

- A. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- C. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- D. Bar Grating: NAAMM MBG 531.
 - 1. Bars: Hot-rolled steel strip, ASTM A 1011/A 1011M, Commercial Steel, Type B.
 - 2. Wire Rods: ASTM A 510/A 510M.
- E. Uncoated Steel Sheet: Hot-rolled steel sheet, ASTM A 1011/A 1011M, Structural Steel, Grade 45 or cold-rolled steel sheet, ASTM A 1008/A 1008M, Structural Steel, Grade 50.
- F. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50, with G90 coating.
- G. Aluminum-Zinc, Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50, with AZ60 coating.
- H. Castings: Either gray or malleable iron unless otherwise indicated.
 - 1. Gray Iron: ASTM A 48/A 48M, Class 30.
 - 2. Malleable Iron: ASTM A 47/A 47M.

2.6 COATING MATERIALS

- A. Shop Primers for Steel: Provide primers that comply with
- B. Epoxy Zinc-Rich Primer for Uncoated Steel: Complying with MPI #20 and compatible with coating specified to be applied over it.

2.7 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size.
- C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.8 STEEL FINISHES

- A. Surface Preparation: Clean surfaces according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning." After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.
- B. Powder Coating: Immediately after cleaning, apply manufacturer's standard two-coat finish consisting of epoxy primer and TGIC polyester topcoat to a minimum total dry film thickness of not less than 8 mils. Comply with coating manufacturer's written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range .
- C. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils per applied coat, to surfaces that are exposed after assembly and installation, and to concealed surfaces.
- D. Shop-Painted Finish: Comply with Section 099600 "High-Performance Coatings."
- E. High-Performance Coating: Apply intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - 1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

2.9 METALLIC-COATED-STEEL FINISHES

- A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a zinc-phosphate conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780/A 780M.
- C. Powder Coating: Immediately after cleaning and pretreating, apply manufacturer's standard TGIC polyester powder-coat finish to a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range .
- D. Powder Coating: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat finish consisting of zinc-rich epoxy prime coat and TGIC polyester topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range .
- E. High-Performance Coating: Apply epoxy primer, polyurethane intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop,

Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
 1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.
- C. Post Setting: Set posts in concrete with mechanical anchors at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
 - b. Concealed Concrete: Top 2 inches below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.
 3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.

4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.
 - a. Extend posts at least 5 inches into sleeve.
 - b. After posts have been inserted in sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.
5. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch larger than outside diagonal dimension of post.
 - a. Extend posts at least 5 inches into concrete.
 - b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
6. Space posts uniformly at 6 feet o.c.

3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

END OF SECTION 323119

SECTION 323300 - SITE FURNISHINGS

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. Seating.
- 2. Bicycle racks.
- 3. Trash receptacles.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts cast in concrete footings.
- 2. Section 055000 "Metal Fabrications" for bollards and bollard covers.
- 3. Section 312000 "Earth Moving" for excavation for installing concrete footings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Samples for Initial Selection: For units with factory-applied finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For site furnishings manufactured with preservative-treated wood.
 - 1. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SEATING

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. Landscape Forms.
 - a. Style
 - 1) Hebi - Curved Solid
 - 2) Flor - Large

B. Seat:

1. Material:
 - a. Reinforced cast stone (concrete): Manufacturer's proprietary blend of portland cement, sand, aggregate, and color admixture.
 - 1) Use only one brand, type and source of cement for entire Project.
 - 2) Provide integral colored concrete with lightfast (UV and fade resistant) color pigments.
 - 3) Reinforced with steel bar framework.
2. Size:
 - a. 'Heb'i: Curved, Solid, 114"w X 28"d X 18" h
 - b. 'Flor' large: – 97-1/4"w x 106-1/4"d x 16-1/2"h
3. Finish:
 - a. Acid Etched
 - b. Color: Grey

2.2 BICYCLE RACKS

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. Madrax; Graber Manufacturing, Inc.
 - a. Model
 - 1) UX200-10

B. Bicycle Rack Construction:

1. Frame: Steel.
 - a. Tubing OD: Not less than 2 inch Square.
2. Style: Double-side parking.
 - a. Overall Height: As indicated 36 inches.
 - b. Overall Width: As indicated 126 inches.
 - c. Overall Depth: As indicated 32 inches.
 - d. Capacity: Designed to accommodate no fewer than 10 bicycles.

3. Security: Designed to lock wheel and frame.
4. Accessories:
5. Installation Method: Surface flange anchored at finished grade to substrate indicated.

C. Steel Finish: Galvanized.

1. Color:

2.3 TRASH RECEPTACLES

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. Landscape Forms.
 - a. Model
 - 1) Parc Vue Receptacle
 - b. Style
 - 1) Side opening
 - 2) Capacity: 30 Gallons
 - c. Mounting: Surface Mounted
 - d. Top: Side Opening: 20" diameter x 1-1/4" tall at top of dome.

B. Trash Receptacles:

1. Receptacle Shape and Form: Round cylinder; with opening for depositing trash inside of lid or top.
2. Receptacle Height: 43 inches.
3. Overall Width: 21-1/4 inches.
4. Inner Container: Rigid plastic container with drain holes; designed to be removable and reusable.
5. Capacity: Not less than 30 gal.
6. Service Access: Fixed lid or top, side access; inner container and disposable liner lift or slide-out for emptying; lockable with padlock hasps.

C. Steel Finish: Galvanized and color coated.

1. Color: As selected by Architect from manufacturer's full range.

2.4 MATERIALS

A. Steel and Iron: Free of surface blemishes and complying with the following:

1. Litter Frame Assembly: Basket is formed of 3/4" #13F expanded steel and has two 3/8" diameter steel rod rings welded on the top and bottom of the assembly. Basket is attached to cast iron base with three stainless steel threaded studs.

B. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.

1. Polyethylene: Fabricated from virgin plastic HDPE resin.

- C. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality, tamperproof, vandal and theft resistant.
 - 1. Angle Anchors: For inconspicuously bolting legs of site furnishings to on -grade substrate; one per leg.
- D. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M; recommended in writing by manufacturer, for exterior applications.
- E. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.
- F. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
 - 1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.
 - 2. Hot-Dip Galvanizing: According to ASTM A123/A123M, ASTM A153/A153M, or ASTM A924/A924M.

2.5 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.
- C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
- E. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.6 GENERAL FINISH REQUIREMENTS

- A. 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.

2.7 STEEL AND GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, 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 installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.
- D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

END OF SECTION 323300

SECTION 328400 – IRRIGATION SYSTEMS

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 valves, piping, sprinklers, specialties, accessories, controls, and wiring for irrigation systems.
- B. Field verify capacity of the existing secondary irrigation system complete including but not limited to flow, capacity, filter requirements and etc.
- C. Install an automatic filter system with drain.
- D. Install a pre-manufactured pump station in the location shown.

1.3 RELATED WORK

- A. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 011000 “Summary.”
 - 2. Specification Section – Soils Report for reference only.
 - 3. Section 329300 “Plants.”
 - 4. Division 26 Sections for electrical power materials and installations.

1.4 DEFINITIONS

- A. Piping sizes used in this Section are normal pipe size (NPS) in inches. Tube sizes are standard size in inches. Equivalent SI (metric) sizes are indicated in millimeters (mm) in parentheses.
- B. Supply Piping: Piping from water source to connection to irrigation system pressure piping. Piping is under same pressure as water supply. Piping in this category is not included in this Section.
- C. Pressure Piping: Piping downstream from supply piping to and including control valves. Piping is under irrigation system pressure. Piping in this category includes pressure regulators, water meters, and backflow preventers, when used.
- D. Circuit Piping: Piping downstream from control valves to irrigation system sprinklers, emitters, devices, and drain valves. Piping is under pressure (less than pressure piping) during flow.
- E. Control Valve: Manual or automatic (electrically operated) valve for control water flow to irrigation system zone, including isolation or zone valves.
- F. Drain Piping: Downstream w circuit or pressure piping drain valves. Piping is not under pressure.

- G. Drain Valve: Manual drain valve for draining of irrigation system circuit piping.

1.5 CODES AND STANDARDS

- A. Plumbing code compliance: Comply with any applicable portions of the Utah state plumbing code pertaining to the selection of materials and the installation of irrigation systems.
- B. Water purveyor compliance: Comply with requirements of purveyor supplying water to the project.
- C. Any permits that are needed for the installation of construction of any work included under this contract, which are required by the authorities of jurisdiction, shall be obtained and paid for by the contractor following whatever ordinances, regulations and codes requiring the permits. If the authorities of the jurisdiction require inspection at said points of the installation, the contractor shall arrange for, and be present at, any such inspections.
- D. Additional work or furnishing of materials required due to inspection by the authorities of jurisdiction shall be furnished at no cost to the owner. If the specifications for this project and existing ordinances, regulations or codes are in conflict, the conflict shall be noted in writing by the contractor to the owner's authorized representative, and any necessary changes in work shall follow an established procedure for claims for extra compensation.

1.6 SYSTEM PERFORMANCE REQUIREMENTS

- A. Location of Sprinkler and Devices: Design location is approximate. Make minor adjustments necessary to avoid planting and obstructions such as signs and light standards.
- B. Minimum Water Coverage: Not less than:
 - 1. Turf Areas: 100 percent.
 - 2. Other Planting Areas: 100 percent.
- C. Components and Installation: Capable of producing piping systems with the following minimum working pressure ratings except where indicated otherwise.
 - 1. Pressure Piping: 150 psig (1035 kPa).
 - 2. Circuit and Drain Piping: 100 psig (690 kPa).

1.7 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data including pressure rating, rated capacity, settings, and electrical data of selected models for the following:

1. Pressure regulators.
 2. Valves, including general-duty, underground, manual and automatic control, and quick-coupler types, and valve boxes.
 3. Sprinklers, including emitters, drip tubes, and devices.
 4. Controls, including controller wiring diagrams.
 5. Wiring.
 6. Pipe, including sleeves, lateral, supply, conduit and drain.
 7. Prefabricated Control Panel with CCU and Controllers etc.
 8. Master Valve/Flow Sensor
 9. Automatic Filters
 10. Concrete Vaults
 11. Prefabricated Pump Systems
- C. Wiring diagrams for electrical controllers, valves, and devices.
- D. Maintenance data for inclusion in "Operating and Maintenance Manual" specified in Division 1 Section "Project Closeout" for the following:
1. Pressure regulators.
 2. Automatic control valves.
 3. Sprinklers.
 4. Controllers.
 5. Central Control Equipment.
 6. Prefabricated Control Panel with CCU and Controllers etc.
 7. Master Valve/Flow Sensor
 8. Automatic Filters
 9. Prefabricated Pump Systems
- E. Irrigation Schedule: A monthly Irrigation Schedule shall be prepared that covers the initial 120-day plant establishment period and the typical long-term use period. This schedule shall consist of a table with the following information for each valve:
1. Plant type (for example, turf, trees, low water use plants);
 2. Irrigation type (for example, sprinklers, drip, bubblers);
 3. Flow rate in gallons per minute;
 4. Precipitation rate in inches per hour (sprinklers only);
 5. Run time in minutes per day;
 6. Number of water days per week, and
 7. Cycle time to avoid runoff.
- The irrigation schedule shall rely on the estimated landscape water use calculations and shall be adjusted as necessary for irrigation efficiency, soil conditions, slope, and microclimate conditions. (See Appendix B)
- F. Water Use Efficiency Review: Following construction a Water Use Efficiency Review (Audit) will be conducted by a certified Landscape Irrigation Auditor. The auditor shall be independent of the contractor, design firm and owner / developer of the project. The water performance audit will verify that the irrigation system complies with the minimum standards required by this ordinance. The auditor shall furnish a certificate to the DFCM, Landscape Architect and installer certifying compliance with the minimum distribution requirements and an irrigation schedule.
- G. Qualification Data: Certification of The Certified Irrigation Contractor employed by the Irrigation System installer.

- H. Mock ups: This contractor will provide a mockup of both a three valve manifold mockup and a six valve manifold mock up in a concrete vault prior to the pre-construction meeting.
- I. Manufacturer Information: The District requires that the contractor submit all invoices showing purchases and pricings for materials installed for manufacturer rebate.

1.8 QUALITY ASSURANCE

- A. Comply with requirements of utility supplying water for prevention of backflow and backsiphonage.
- B. Comply with requirements of authority with jurisdiction for irrigation systems.
- C. Installer Qualifications: Engage an experienced installer who has completed minimum of 6 irrigation systems similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- D. Listing/Approval Stamp, Label, or Other Marking: On equipment, specialties, and accessories made to specified standards.
- E. Listing and Labeling: Equipment, specialties, and accessories that are listed and labeled.
 - 1. The Terms “Listed” and “Labeled”: As defined in “National Electrical Code,” Article 100.
 - 2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulation 1910.7.
- F. Product Options: Irrigation system piping, specialties, and accessories are based on specific types, manufacturers, and models indicated. Components with equal performance characteristics produced by other manufacturers may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as judged by the Architect, unless noted “No Substitute”. The burden of proof of product equality is on the Contractor. Refer to Division 1 Section “Product Substitutions.” No requests for substitutions will be reviewed after bids have been received by Owner.

1.9 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Verify that irrigation system piping may be installed in compliance with original design and referenced standards.
- B. Site Information: Reports on subsurface condition investigations made during design of the Project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions (between soil borings). Owner assumes no responsibility for interpretations or conclusions drawn from this information.

1.10 SEQUENCING AND SCHEDULING

- A. Maintain uninterrupted water service to building during normal working hours. Arrange for temporary water shutoff with Owner.

- B. Coordinate irrigation systems work with landscape work specified in Division 2 Section 02900 - Landscape Planting.

1.11 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below. Package them with protective covering for storage and label clearly describing contents.
 - 1. Quick Couplers: Furnish quantity of units equal to 10% of amount of each size installed, but not less than 1.
 - 2. Sprinklers: Furnish quantity of units equal to 10% of amount of each type installed, but not less than 10.
 - 3. Dripper Tube: Furnish quantity of units equal to 10% of amount of each type installed.
 - 4. Valve Keys: Furnish quantity of tee-handle units equal to 25% of amount of each type key-operated, control valve installed, but not less than 2 each.
 - 5. Quick Coupler Hose Swivels: Furnish quantity of units equal to 25% of amount of each type quick coupler installed, but not less than 2.
 - 6. Quick Coupler Operating Keys: Furnish quantity of units equal to 25% of amount of each type quick coupler installed, but not less than 3.

1.12 WARRANTY/GUARANTEE

- A. During the period of one (1) year from and after the final acceptance of the completed irrigation system, the Contractor shall at his own expense, make all needed repairs or replacement due to defective workmanship or materials which in the judgment of the Owner or Owner's representative, shall become necessary during such period. If, within seven (7) calendar days after mailing of the written notice or verified communication by the Owner to the Contractor or his agent, requesting such repairs or replacement, the Contractor shall neglect to make repairs, Owner may make such repairs at the Contractor's expense. In the case of emergency where, in the judgment of the Owner, delay could cause serious loss, hazard or damage to persons or property, then repairs, replacement and security, both temporary and/or permanent, may be provided by such persons as the Owner may employ, after verbal communication with Contractor without notice being sent to the Contractor, and the Contractor shall pay all costs related thereto.
- B. The guarantee shall be in the form of a letter from the Contractor addressed to the Owner. The letter shall incorporate the language stated above and be signed by an authorized officer/agent or Owner of the Contractor.
- C. During the guarantee period, the Contractor will drain the system in the fall and put the system back into operation in the Spring. This work shall be done in the presence of the Owner's representative and maintenance personnel.

1.13 RECORD DRAWINGS:

- A. Any deviation from plan layout should be indicated on the final "Record" Drawings. This Contractor shall make an exact measured and dimensioned drawing showing locations of all piping, wiring, control, valves and quick coupler valves. Record drawings shall also include the size and location of thrust blocks.

- B. Record Drawings shall be furnished to the Landscape Architect at the time of Substantial Completion Inspection before a letter of Substantial Completion for the irrigation sprinkler system will be issued.
- C. The Contractor shall supply the Landscape Architect with record drawing information in AutoCad format before final acceptance of the irrigation system.

1.14 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver irrigation system components in manufacturer's original undamaged and unopened containers with labels intact and legible.
- B. Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends, both threaded or plain.
- C. Store and handle materials to prevent damage and deterioration.
- D. Provide secure, locked storage for valves, sprinkler heads, and similar components that cannot be immediately replaced, to prevent installation delays.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Automatic Filters
 - a. Amiad USA.
 - b. Tekleen Automatic Filters.
 - 2. Pressure Regulators
 - a. Bermad.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Braukmann.
 - d. Watts Regulator Co.
 - e. Wilkins Regulator Div., Zurn Industries, Inc.
 - 3. Gate Valves for Underground Installation:
 - a. Mueller Co. 2500 series (Design Standard)
 - b. American Darling Valve Div., American Cast Iron Pipe Co.
 - c. Clow Valve Co. Div., McWane, Inc.
 - d. Kennedy Valve Div., McWane, Inc.
 - e. Stockham Valves & Fittings, Inc.
 - f. Waterous Co.
 - 4. Valve Bank Isolation:
 - a. Apollo Model 70 series ball valve (Design Standard)
 - 5. Corporation Stops for Underground Installation

- a. Ford Meter Box Co., Inc.
- b. Hays Div., Romac Industries.
- c. A.Y. McDonald Mfg. Co.
- d. Mueller Co., Grinnell Corp.
6. Valves for Aboveground and Pit Installation
 - a. Grinnell Supply Sales Co., Grinnell Corp.
 - b. Nibco, Inc.
 - c. Stockham Valves & Fittings, Inc.
 - d. Walworth Co.
 - e. Watts Regulator Co.
7. Automatic Control Valves
 - a. Rain Bird Sprinkler Mfg. Corp. (No Substitute per District)
8. Control Valve Boxes
 - a. Ametek by Plymouth Products Div., AMETEK
 - b. Brooks Products, Inc., Polyplastics Div.
 - c. Carson Industries, inc.
 - d. DFW/HPI by Hefco Plastics, Inc.
 - e. National Diversified Sales, Inc.
9. Quick Couplers
 - a. Rain Bird Sprinkler Mfg. Corp. (No Substitute per District)
10. Sprinklers
 - a. Rain Bird Sprinkler Mfg. Corp. (No Substitute per District)
11. Controllers
 - a. Rain Bird Sprinkler Mfg. Corp. (No Substitute per District)
12. Pipe
 - a. Pacific Western Extruded Plastics Co.
 - b. Eagle Pacific Industries, Inc.
 - c. J-M Manufacturing Company, Inc.
13. Master Valve
 - a. Netafim
 - b. Amiad
14. Control Panel
 - a. Rainbird Manufacturing (No Substitute per District)
15. Swing Joint Assembly
 - a. Rainbird Sprinkler Mfg.
 - b. Spears Mfg.
 - c. Lasco
16. Wire
 - a. Paige Electric Co. (or approved equal)

2.2 PIPES AND TUBES

- A. Refer to Part 3 Article "Piping Applications" for identification of systems where pipe and tube materials specified below are used.
- B. Polyvinyl Chloride (PVC) Plastic Pipe: ASTM D 1785, PVC 1120, Schedule 40, 160 psig (1100 kPa) minimum pressure rating for 3-inch (100-mm) and smaller sizes, with plain, threaded or bell ends.
 1. PVC Socket Fittings: Schedule 40: ASTM D 2466.
- C. Polyvinyl Chloride (PVC) Plastic Pipe: ASTM D 1785, PVC 1120 compound, Schedule 80.
 1. PVC Socket Fittings: Schedule 80: ASTM D 2467.

2. PVC Threaded Fittings: Schedule 80: ASTM D 2464.

- D. PVC, Pressure-Rated Pipe: ASTM D 2241, PVC 1120 compound, SDR 21 Bell and Ring for pipe 4" and larger.
- E. Flexible Polyethelene Pipe: Flexible pipe with a nominal inside dia. 0437' pressure rated at 80 psi at 110°F.
- F. Pipe Sleeves: Pipe sleeves shall be PVC Class 160 or better.

2.3 PIPE AND TUBE FITTINGS

- A. Refer to Part 3 Article "Piping Applications" for identification of systems where pipe and tube fitting materials specified below are used.
- B. Cast-Bronze Flanges: ASME B16.24, Class 150, raised ground face, bolt holes spot faced.
- C. Polyvinyl Chloride (PVC) Plastic Pipe Fittings: ASTM D2467, Schedule 80, socket-type and ASTM D2464, Schedule 80, threaded fittings.
- D. Polyvinyl Chloride (PVC) Plastic Pipe Fittings: ASTM D2467, Schedule 40, socket-type and ASTM D2464, Schedule 40, threaded fittings.
- E. Polyvinyl Chloride (PVC) Plastic Pipe Fittings: ASTM D2241, PVC 1120 compound, SDR 21.
- F. Polyvinyl Chloride (PVC) Plastic Pipe Fittings: ASTM D2467, Schedule 40, socket-type.
- G. Ductile Iron: Deep Socket Cast Iron Fittings: ASTM A536.
- H. Mechanical Joint: Mechanical Joint Steel Fittings: AWWA A21.10
- I. Galvanized Pipe: ASTM A 733, made of ASTM A 53/A53M or ASTM A 106/A106M standard weight seamless-steel pipe and fittings with thread ends. All galvanized material to be Domestic fabricated material.
- J. Barb Fittings: Spiral Barb Fittings for 1/2" and 3/4" inlet sprinklers. Max operating pressure 80 psi and 8 gpm.

2.4 JOINING MATERIALS

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joining materials not included in this Section.
- B. Solvent Cement: ASTM F656 primer and ASTM D2564 solvent cement in color other than orange.
- C. Gaskets for Plastic Flanged Joints: Materials recommended by plastic pipe and fittings manufacturer.
- D. Gaskets for Plastic Joints: Trans gaskets as recommended the fittings manufacturer.

2.5 SWING JOINTS

- A. All sprinkler heads shall be installed on a “swing joint” assembly. Lawn spray heads and small rotors with an inlet size 3/4” and smaller shall be installed as per manufacturer’s recommendations with “funny pipe” and “swing ells” as manufactured by Rain Bird or approved equal. All large stream rotor and impact heads shall be installed with three 1” schedule 40 marlex street ells and one schedule 80 1”X12” nipple. Prefabricated swing joint assemblies by Spears Manufacturing or other approved equal can be substituted if desired. All “swing joint” configurations shall match detail drawings.

2.6 VALVES

- B. General: Valves are for general-duty and underground applications. Refer to “Valve Applications” Article for locations of various valve types specified in this Article. Refer to “Control Valves” Article for control valves and accessories and “Backflow Preventers” Article for backflow preventer valves.
- C. Non-rising Stem Gate Valves 3-inches (DN 80) and Larger: AWWA C500, cast-iron double disc, bronze disc and seat rings or AWWA C509, resilient seated; bronze stem, cast-iron, or ductile-iron body and bonnet, stem nut, 200 psig (1380 kPa) working pressure; and ends that fit NPS dimension, PVC pipe. Include elastomeric gaskets. All gate valves shall be domestic, resilient wedge gate valves.
- D. Valve Boxes: Cast-iron box with top section and cover with lettering “WATER,” bottom section with base to fit over valve and barrel approximately 5-inches (127 mm) in diameter, and adjustable cast-iron extension of length required for depth of bury of valve.
 - 1. Provide steel tee-handle shutoff rod with each valve box. Include tee-handle, shutoff rod with one pointed end, stem of length to operate valve, and end fitting valve operating nut.
- E. Curb Stops 2-inches (DN 50) and Smaller: Bronze body, ground key plug or ball, 150 psig (1035 kPa) minimum pressure rating, wide tee head, with inlet and outlet to match service piping material.
- F. Service Boxes for Curb Stops: Cast-iron box with telescoping top section of length required for depth of bury of valve. Include cover with lettering “WATER” and bottom section with base of size to fit over curb stop and barrel approximately 3-inches (75 mm) in diameter.
 - 1. Provide steel tee-handle shutoff rod with each service box. Include tee-handle, shutoff rod with one pointed end, stem of length to operate curb stop, and slotted end fitting curb stop head.
- G. Bronze, Non-rising Stem Gate Valves, 2-inches (DN 50) and Smaller: MSS SP-80, Type 1, solid wedge; non-rising, copper-silicon-alloy stem; Class 125, body and screw bonnet of ASTM B 62 cast bronze, with threaded or solder-joint ends. Include polytetrafluoroethylene (PTFE) – impregnated packing, brass packing gland, and malleable-iron handwheel.
- H. Plastic Valves: Polyvinyl Chloride (PVC) Plastic, with 150 psig (1035 kPa) minimum pressure rating, ends compatible to piping where valve is to be installed, and tee handle.
- I. Ball Valves: Ball valves shall be solid bronze meeting Federal Specification WW-V-35C, TYPE II, COMPOSITION: BZ, STYLE: 3. Size shall be the same size as the main line on which it is

installed. Valves shall be installed on the up-stream side of the electric remote control valve manifold and in the same valve box. NOTE: Only one (1) ball valve required per manifold.

- J. Quick-Couplers: Factory-fabricated, 2-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH Threads for garden hose on outlet; and operating key.
 - 1. Locking Top Option: Include vandal-resistant, locking feature with two matching keys.
- K. Master Valve: Electric remote control operated valve. Class 125, Main valve and actuator cast iron ASTM A 126 class B. Master valve shall be provided with a manual-operating feature to enable valve to be opened manually or in case of power outage.
- L. Valve Bank Isolation: Provide a domestic brass ball valve with a minimum 200 psi rating. Valve shall be an Apollo model 70 series or approved equal.
- M. Flow Sensor/Flow Transmitter: Pre-installed in PVC tee or saddle mount. Flow rate 0.5 to 30 feet per second. Operates with two wire system.
- N. Drain Valves: All drain valves shall be 3/4" brass full turn ball cocks and installed as per details on the Drawings. Valves shall be tested for 150 psi working pressure. This valve is to be installed on mainlines only.

2.7 CONTROL VALVES

- A. Description: Manufacturer's standard control valves for circuits, of type and size indicated, and as follows:
 - 1. Provide cast-bronze bodies, unless otherwise indicated.
 - 2. Manual Control Valves: MSS SP-80, Class 125, globe valves.
 - 3. Key-Operated, Manual Control Valves: MSS Sp-80, Class 125, globe valves, fitted for key operation.
 - 4. Automatic Control Valves: Diaphragm-type, normally closed, with manual flow adjustment, and operated by 24-volt-a.c. solenoid.
 - 5. Automatic Drain Valves: Designed to open for drainage when line pressure drops below 3 psig (20 kPa). Not for use on pressure piping.
 - 6. All control valves used shall be scrubber valves.
 - 7. All valve in groups of three or more shall be installed in a Concrete Vault.
- B. Control Valve Vaults: All valve in groups of three or more shall be installed in a Concrete Vault. All vaults shall be precast concrete vaults with metal skid proof lockable lids.
 - 1. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3-inches (75 mm) maximum to 3/4-inch (19 mm) minimum.
 - 2. Precast vaults shall be of sufficient size to house six (6) electric remote control valves with unions, and still allow room for maintenance without having to excavate or perform similar operations. Vault shall have lock down lids.
- C. Control Valve Boxes: Carson Brooks Polyethylene (PE), acrylonitrile-butadiene-styrene (ABS), fiberglass, polymer concrete, or precast concrete box and cover. Install jumbo 1760 valve boxes.
 - 1. Drainage Backfill: Cleaned 1" gravel or crushed stone, 6" deep.
 - 2. Foundation: Provide a pressure treated foundation of 4"x4" lumber or brick.

3. Valve boxes shall be of sufficient size to house electric remote control valves with unions, and still allow room for maintenance without having to excavate or perform similar operations. Boxes shall have lock down lids and shall meet ASTM D638 for tensile strength of 4,300 pounds per square inch.
 4. No more than one valve shall be in each plastic valve box.
- D. Service Boxes for Key-Operated Control Valves: Cast-iron box with telescoping top section of length required for depth of bury of valve. Include cover with lettering "WATER," and bottom section with base of size to fit over curb stop and barrel approximately 3-inches (75 mm) in diameter.
1. Include valve key, 36-inches (915 mm) long with tee handle and key end to fit valve.

2.8 SPRINKLERS

- A. Description: Manufacturer's standard sprinklers designed to provide uniform coverage over entire area of spray shown on Drawings at available water pressure, as follows:
1. Housings: plastic, except where material is specified.
 2. Pop-up, Spray: Fixed pattern, with screw-type flow adjustment and stainless steel retraction spring.
 3. Pop-up, Rotary Spray: Gear drive, full-circle and adjustable part-circle type.
 4. Bubblers: Fixed pattern, with screw type flow adjustment.

2.9 AUTOMATIC CONTROL SYSTEM

- A. Description: Low-voltage controller system made for control of irrigation system automatic control valves. Controller operates on 120 volts a.c. building power system, provides 24 volts a.c. power to control valves.
- B. Exterior Control Enclosures: Weatherproof enclosure with locking cover and two matching keys. Enclosure construction complies with NFPA 70 and NEMA 250, Type 4, and includes provision for grounding.
1. Material: Enameled-steel, sheet metal.
- C. Transformer: Internal-type, and suitable for converting 120 volts a.c. building power to 24 volts a.c. power.
- D. Controller Stations for Automatic Control Valves: Include switch for manual or automatic operation of each station.
- E. Timing Device: Adjustable, 24-hour, 14-day clock to operate any time of day. See Irrigation Schedule and Legend for model and manufacturer.
- F. Lightning Protection: Provide manufacturer's standard lightning protection on each controller. Coordinate with electrical.
- G. Wiring: UL 493, solid copper conductor, insulated cable, suitable for direct burial.
1. Feeder Circuit Cables: Type UF, No. 14 AWG minimum, between valves and controllers.

2. Control Wiring: Rain Bird, MaxiCom approved signal communication wire, Type PE39.

H. Two Wire Systems:

1. Decoders shall be installed according to manufacturer's specification and shall be the brand, size and type shown on the drawings.
2. Two wire systems shall be UL 493, solid copper conductor, insulated cable.
3. Surge Suppression decoders to be Yellow. Sensor Decoders to be Green.
4. All grounding shall be installed per manufacturer's specifications. Ground rods with CAD Weld are required.

- I. Valve wire sizing chart: See Appendix A at end of section.

2.10 AUTOMATIC FILTER

- A. Description: Manufacturer's standard automatic filter with a self-cleaning mechanism driven by an electric motor.
- B. Filter shall be plumbed with an automatic valve to flush debris from filter. Discharge side of valve will be plumbed to allow water to flush from filter without flooding box or other structures. Piping attached to discharge side of valve will have adequate unions or other features to allow filter to be removed from housing for maintenance.

2.11 CENTRAL CONTROL SYSTEM

- A. Description: Low-voltage central control system, CCU-6, made for central control of irrigation system automatic controllers. Controller operates on 120 volts a.c. building power system, provides 24 volts a.c. power to controller.
- B. Exterior Control Enclosures: Weatherproof enclosure with locking cover and two matching keys. Enclosure construction complies with NFPA 70 and NEMA 250, Type 4, and includes provision for grounding.
 1. Material: Enameled-steel, sheet metal.
- C. Lightning Protection: Provide manufacturer's standard lightning protection on each controller. Coordinate with electrical.
- D. Wiring: six pair telephone cable.
- E. Maxi-com components: All components and configurations shall meet the specifications and warranty requirements of Rainbird Corporation.

2.12 IDENTIFICATION

- A. Refer to Division 2 Section "Earthwork" for plastic underground warning tapes.

2.13 THRUST BLOCKS

- A. All fittings adjacent to thrust blocks shall be wrapped in plastic sheeting to guard against interfering with any future disassembly of fitting or piping.

All main lines shall have a thrust block of poured concrete installed at each change of direction. The thrust block shall be of sufficient size for the pipe involved and rest on undisturbed ground. Construct as follows:

STEP 1.

Multiply the working pressure by the appropriate value shown in the following table to obtain total thrust in N (lb.):

PIPELINE THRUST FACTORS * ^

Pipe size		Dead end	90°	45°	22°
<u>in.</u>	<u>mm</u>	<u>or tee</u>	<u>elbow</u>	<u>elbow</u>	<u>elbow</u>
3"	89	9.80	13.90	7.51	3.82
3 1/2"	102	12.80	18.10	9.81	4.99
4"	114	16.20	23.00	12.40	6.31
5"	141	24.70	35.00	18.90	9.63
6"	168	34.80	49.20	26.70	13.60
8"	219	59.00	83.50	45.20	23.00
10"	273	91.50	130.00	70.00	35.80
12"	324	129.00	182.00	98.50	50.30

* Based on thrust per kPa (PSI) pressure.

^ Blocking for cross may not be needed with long branch lines.

STEP 2.

Determine the bearing strength of the soil from the table below:

BEARING STRENGTH OF SOILS

<u>Soils and safe bearing loads</u>	<u>lb/ft⁵</u>	<u>kPa</u>
Sound shale	10,000	500
Cemented gravel and sand		
difficult to pick	4,000	200
Coarse and fine compact sand	3,000	150
Medium clay - can be spaded	2,000	100
Soft clay	1,000	50
Muck	0	0

See Soils Report for soil type

STEP 3.

Divide the total thrust obtained in Step 1 by the bearing strength of the soil to get the area needed, m⁵(ft⁵).

SIDE THRUST ALTERNATIVE PROCEDURE

Pipe size		Side thrust per degree.	
<u>in.</u>	<u>mm</u>	<u>lb</u>	<u>N</u>
3"	89	17.10	76.10
3 1/2"	102	22.40	99.60
4"	114	28.30	125.90

5"	141	43.10	191.70
6"	168	60.80	270.50
8"	219	103.00	458.20
10"	273	160.00	711.70
12"	324	225.00	1,000.80

* Based on side thrust per 689 kPa (100 PSI) pressure per degree of deflection.

NOTE: Multiply side thrust from table by degree of deflection times kPa (PSI) divided by 100 to obtain total side thrust in N(lb).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Investigate and determine available water supply, water pressure and flow characteristics.
- B. Prior to installation of irrigation system, the contractor must verify the supply pressure at the work site. If there is a failure to obtain the needed pressure or if an excess pressure situation exists for normal operation, the contractor must contact the owner for any adjustments to the supply or irrigation system design. Failure to report any discrepancies in pressure due to any reason, and any installation done prior to notification of owner shall be done at the expense of the contractor.

3.2 PREPARATION

- A. Set stakes or flags to identify proposed sprinkler locations. Obtain Architect's approval before excavation.

3.3 PAVING WORK

- A. Cutting and patching of asphalt paving is specified in Division 2 Section "Hot-Mixed Asphalt Paving."
- B. Cutting and patching of concrete paving is specified in Division 2 Section "Portland Cement Concrete Paving."
- C. Install piping in sleeves where crossing sidewalks, roadways, parking lots, and railroads.

3.4 PIPING APPLICATIONS

- A. Refer to Part 2 of this Section for detailed specifications for pipe and fittings products listed below. Use pipe, tube, fittings, and joining methods according to the following applications. Piping in pits and aboveground may be joined with flanges instead of joints indicated.
- B. Use pipe, tube, fittings, and joining methods according to the following applications.
- C. Pressure Piping Underground: Use the following:

1. 3-inches (DN 80) and Smaller: ASTM D 1785, Schedule 40, polyvinyl chloride (PVC) plastic pipe; ASTM D 2466, Schedule 40, PVC plastic, socket-type pipe fittings; and solvent-cemented joints.
 2. 4-inches (DN 80) and Larger: ASTM D 2241, Class 200, polyvinyl chloride (PVC) plastic pipe; with flanged or deep socket fittings.
- D. Circuit Piping: Use the following:
1. All Sizes: ASTM D 1785, Schedule 40, polyvinyl chloride (PVC) plastic pipe; ASTM D 2466, Schedule 40, PVC plastic, socket-type fittings; and solvent-cemented joints.
 2. No ¾" piping shall be installed anywhere on the District systems.
 3. Lateral line size for all rotor irrigation zones shall be 1-1/4" minimum.
- E. Branches and Offsets at Sprinkler and Devices: ASTM D 1785, Schedule 80, polyvinyl chloride (PVC) plastic pipe with threaded ends; ASTM D 2464, Schedule 80, PVC plastic, threaded fittings; and threaded joints.
- F. Drain Piping: ASTM D 1485, Schedule 40, polyvinyl chloride (PVC) plastic pipe; ASTM D 2466, Schedule 40 PVC plastic, socket-type fittings; and solvent-cemented joints.
- G. Sleeves: ASTM D 1785, Schedule 40, polyvinyl chloride (PVC) plastic pipe; ASTM D 2466, Schedule 40, PVC plastic, socket-type fittings; and solvent-cemented joints.
1. All sleeves shall be marked by duct taping a "Deep~1" Sleeve Magnate on both ends of the sleeve at all locations.

3.5 JOINT CONSTRUCTION

- A. Flanged Joints: Align flanges and install gaskets. Assemble joints by sequencing bolt tightening. Use lubricant on bolt threads.
- B. Threaded Joints: Thread pipes with tapered pipe threads according to ASME B1.20.1, apply tape or joint compound, and apply wrench to valve ends into which pipes are being threaded.
- C. Polyvinyl Chloride (PVC) Piping Gasketed Joints: Construct joints between underground AWWA-type, cast-iron valves and NPS PVC pipe; with elastomeric seals that fit pipe diameter and valve ends; and lubricant, according to ASTM D 3139.
- D. Polyvinyl Chloride (PVC) Piping Solvent-Cemented Joints: Construction joints according to ASTM D 2672 and ASTM D 2855.
 1. Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F 402 for safe handling when joining plastic pipe and fittings with solvent cements.
- E. Ductile Iron: Deep Socket Cast Iron Fittings shall be installed on all mainline pipe 3" or larger.

3.6 PIPING SYSTEMS – COMMON REQUIREMENTS

- A. General Locations and Arrangements: Drawings indicated general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, and in other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

- B. Bedding material shall be placed a minimum of 6" in all directions around all main pressure line piping. Lateral line piping shall have a minimum of 3" of such bedding.
- C. Install piping at a uniform slope of 6-inches per 100-feet (1:200) minimum, down to drain points.
- D. Install components having pressure rating equal to or greater than system operating pressure.
- E. Install piping free of sags and bends.
- F. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- G. Install fittings for changes in direction and branch connections.
- H. Piping Connections: Except as otherwise indicated make piping connections as specified below.
 - 1. Install unions, in piping 2-inches (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inch (DN 50) or smaller threaded pipe connection.
 - 2. Install flanges, in piping 2½-inches (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
 - 3. Install dielectric fittings to connect piping of dissimilar metals.
- I. INSTALLATION METHOD BY PULLING – ALTERNATE BID: A vibratory plow configured for irrigation pipe bury may be used in lieu of open trenching. Contractor shall have a demonstrated knowledge of this process. Submit list of 3 similar projects at time of bid. Equipment used to install pipe shall be proposed with Bid Document. No deviation will be made for bury depth if this method is used. Lateral line piping must be pulled to a depth of 24". All other requirements for Irrigation Systems will apply. See also Piping Installation below.
 - 1. Lateral lines installed using the pipe pulling method shall be installed with a rubber tire, ride-on vibratory plow with minimum 40 factory horse power. A sod cutter blade shall be installed on the machine in front of the plow blade to pre-cut the sod with a clean even cut. The Contractor shall demonstrate that the equipment proposed for use can place the pipe at the specified depth prior to proceeding with the work. Secure Landscape Architect's approval prior to proceeding.
 - 2. Pipe shall be glued and cured for at least 24 hours prior to pulling.
 - 3. Replace sod. Roll pulled lines with a vibratory roller of sufficient size to level pull line with adjacent grades and finished surfaces.
 - 4. Pot holes for sprinkler equipment and fittings at directional changes shall be neatly dug and of sufficient size for working access, while maintaining minimal practical size. All pot holes shall be backfilled as described for trenching backfill. Replace sod. Completed trench and pot holes shall be graded and finished level with surrounding surfaces.

3.7 TRENCHES:

- A. Trenches shall be dug as wide and deep as necessary to properly place the sprinkling system according to the requirements herein. Any rock uncovered in this excavation shall not be left in the backfill. All excess rock shall be removed from the site by this Contractor and legally disposed of off the property. All trenches shall be backfilled and compacted to insure no settling of the surface, after the lawn is planted.

- B. If backfill soil is rocky or lumpy, protect the pipe and the pipe conduit with 8" of sand or loose, rock free, soil under, over and on sides of pipe. Avoid putting large rocks against pipe during backfilling operation.
- C. All trenches must be compacted to 90% in 6" lifts and watered in. Lines from control valves shall be installed after topsoil is in place and properly graded.
- D. This Contractor, in placing the sprinkling lines, etc., may uncover material not suitable for finished grading. This material shall be removed from the site by this Contractor. After the installation of the lines, the finished grading shall be smoothed over and restored to its original condition, using additional topsoil at this Contractor's expense, if this is necessary. The upper 6" of topsoil removed in the excavation of trenches for pipeline shall be conserved and kept separate from subsoil and reinstalled without mixing with other soil.
- E. Trenches where more than one pipe is to be installed, a distance of 6" is to be maintained between each pipe.
- F. Trenches for, or with wiring shall be wiring shall be a minimum of 12" deep. Wiring shall be buried under pipe with a separation of no fewer than 3"
- G. All trenches are to be 12" away from all curbs, buildings and sidewalks. No exceptions.

3.8 PIPING INSTALLATION

- A. Install underground polyvinyl chloride (PVC) plastic pipe according to ASTM D 2774.
- B. After installation of piping, wires, and blocking, mainline shall be inspected by owner's representative before backfilling of trenches.
- C. Lay piping on solid sub-base, uniformly sloped without humps or depressions.
 - 1. Slope circuit piping down toward drain valve minimum of ½-inch in 10-feet (1:240).
 - 2. Install polyvinyl chloride (PVC) plastic pipe in dry weather when temperature is above 40 deg. F (4 deg. C). Allow joints to cure at least 24-hours at temperature above 40 deg. F (4 deg. C) before testing, unless otherwise recommended by manufacturer.
- D. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel and crushed stone, graded from 3-inches (75 mm) to ¾-inch (19mm) minimum, drain material to 12-inches (300 mm) below grade. Cover drain material with sheet of ASTM D 226, Type II, asphalt-saturated felt and backfill remainder with excavated material. Drain pocket to be minimum 6 cubic feet.
- E. Minimum Cover: Provide following minimum cover over top of buried piping:
 - 1. Pressure Piping: Install to a depth of minimum of 24-inches (600 mm) and a maximum of 30" (762 mm) below finished grade.
 - 2. Circuit Piping: 1Install to a depth of minimum of 12-inches (240 mm) and a maximum of 18-inches (380 mm) below finished grade.
 - 3. Drain Piping: 18-inches (380 mm).
 - 4. Sleeves: 24-inches (600 mm).
- F. Install piping under sidewalks and paving in sleeves.
- G. All pipe threads shall be sealed with Teflon tape and pipe thread compound.

- H. Lines bordering fences, curbs, or sidewalks shall be held 8" away from such items to allow for maintenance and access.
- I. When connecting main pressure line PVC piping to galvanized steel piping in valve manifold, use a Harco coupling, Harco service tee, or mechanical joint repair sleeve with transition gaskets or other fittings as specified on drawings.
- J. All glue joints to be set 24 hours prior to pressurization.

3.9 FLUSHING AND PRELIMINARY TESTING

- A. Flash and test each zone after installation of new piping, swing pipe and prefab swing joint, but before installation of heads and before backfilling is complete. Open control valve completely and flush with a full head of water. Each automatic valve shall then be disassembled, inspected for rocks, cleaned and re-assembled. Install heads and test each zone for coverage.
- B. Testing will be performed after completion of each circuit and again after the completion of the entire system. All repair work will be made at the contractor's expense.

3.10 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, following requirements apply:
 - 1. Buried Valves 3-inches (DN 80) and Larger: AWWA, gate valves, non-rising stem, with stem nut and valve box.
 - 2. Buried Valves 2-inches (DN 50) and Smaller: Bronze-body, curb stop, with tee head, service box and shutoff rod.

3.11 VALVE INSTALLATION

- A. Valves: Install underground valves in valve boxes or pits.
 - 1. Install valves and polyvinyl chloride (PVC) pipe with restrained, gasketed joints.
- B. Curb Stops: Install underground curb stops in service boxes.
- C. Control and Ball Valves: Install in valve control valve boxes, arranged for easy adjustment and removal. Install unions with one (1) on upstream side at each valve manifold.
- D. Install valve tags on all underground irrigation valves.
- E. Master valve/flow meter combination unit shall be installed in valve boxes as per manufacturer specifications, drawings, and detail sheet.
- F. Control valves shall be located as close as possible to where shown on drawings. Avoid locating valves in areas of high pedestrian or vehicular traffic.
- G. Each bank or section of control valves, not in a pre-cast concrete box, shall be located in an adequate size plastic valve box and extensions as specified in section 2.4. Valve box shall be set at finish grade with top of valve stem 4" below top of box and 3" of pea gravel under valve to allow for drainage. Do not install more than one automatic valve per box.

- H. Provide isolation valve at all valve bank locations and as otherwise shown on drawings.
- I. Valves that are grouped together but not in pre-cast concrete boxes shall be grouped on a 2" sub-main/Header assembly and utilize one mainline fitting and isolation valve.

3.12 CONTROL WIRING

- A. All connections to valves and all wire splices shall be watertight.
- B. Control wires must be buried at a minimum of 12" below finish grade and bundled with plastic tape every 25 feet. Tie a loose 20" loop at all valve box, pull boxes, and splice box locations. Wherever wire harness leaves mainline trench, wiring shall be enclosed in adequate size PVC electrical conduit.
- C. All splices shall be enclosed in a plastic valve box and noted on "as built" drawings.
- D. Wires run in same trench as main pressure line or any other pipe shall be set a minimum of 4" from pipe to allow for maintenance access. Wire shall run parallel to pipe and not wrap around or go under pipe unless care is taken to allow clearance for maintenance access.
- E. Two Wire
 - 1. Two wire installations wiring shall be enclosed in adequate size PVC electrical conduit.
 - 2. All splices shall be enclosed in a plastic valve box and noted on "as built" drawings.
 - 3. At Y in two wire paths "Paige Decoder cable fuse device" shall be installed or equivalent
 - 4. Decoders shall be installed according to manufactures specifications and shall be the brand, model, size, and type shown on drawings.
- F. Grounding shall be done according to manufactures specifications
 - 1. Before the controller
 - 2. Every five valves in field or 500ft.
 - 3. Install line surge protector at termination of two wire path
 - 4. Each installed grounding system shall maintain a maximum ground resistance of 10 ohms, or less
 - 5. Refer to the Rain Bird Grounding Recommendations documents for proper specifications on grounding systems installation and grounding system design
 - 6. Grounding rods shall be installed in plastic valve box and noted on "as built" drawings.

Grounding test shall be done. Tester must be approved by Weber School District. Weber School District can provide tester to be paid by the contractor.

3.13 AUTOMATIC FILTER INSTALLATION

- A. Install automatic filter of type, size, and capacity indicated. Include valves and test cocks. Install according to plumbing code and health department authorities with jurisdiction.
- B. Install the entire assembly including electrical panel according to manufacturer's recommendations.

3.14 PRESSURE REGULATOR INSTALLATION

- A. Install pressure regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet and valve bypass where indicated.

3.15 SPRINKLER INSTALLATION

- A. Sprinklers: Flush circuit piping with full head of water and install sprinklers after hydrostatic test is complete.
 - 1. Install lawn sprinklers at manufacturer's recommended heights.
 - 2. Install shrubbery sprinklers at heights indicated.
 - 3. Locate part-circle sprinklers to maintain a minimum distance of 12-inches (400 mm) from walls and 2-inches (50 mm) from other boundaries, unless otherwise indicated.
- B. All sprinkler heads and valve boxes shall be set flush with finish grade unless otherwise specified. Contractor shall insure tops of heads and boxes remain at finish grade, and adjust as required. If any settlement occurs within the 1 year warranty period, the contractor will be required to place such areas back in satisfactory condition, using additional topsoil and new sod if necessary.

3.16 AUTOMATIC CONTROL SYSTEM INSTALLATION

- A. Install controllers according to manufacturer's written instructions and as indicated.
- B. Install controllers on Unistrut or similar mounting system. Attach to wall where shown. Provide and install wire gutter for wiring connections at controller.
- C. Run one extra wire from the adjacent controller to each group of valves for future use and stub into the valve box.
- D. All two wire installations shall be enclosed in a minimum 2" conduit.
- E. Install control wiring in same trench with piping.

3.17 CENTRAL CONTROL SYSTEM INSTALLATION

- A. Install Central Control system according to manufacturer's written instructions and as indicated.
- B. Connect all controllers to the District's Central Control Software as required per project specific connections.

3.18 CONNECTIONS

- A. Connect piping to sprinklers, devices, valves, control valves, specialties, and accessories.
- B. Connect water supplies to irrigation systems. Include backflow preventers on potable water supplies. Include automatic filters on secondary water supplies.
- C. Electrical Connections: Connect to power source, controllers, and automatic control valves.

- D. Minimum requirements for electrical installations are specified in Division 16.
- E. Ground systems according to Division 16 Section “Grounding.”

3.19 FIELD QUALITY CONTROL

- A. Testing: Perform hydrostatic test of piping and valves before backfilling trenches. Piping may be tested in sections to expedite work.
 - 1. Cap and subject the piping system to a static water pressure of 50 psig (345 kPa) above the operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4-hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 2. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
 - 3. Notify Architect 24 hour in advance of pressure testing so test may be observed.

3.20 CLEANING AND ADJUSTING

- A. Flush dirt and debris from piping before installing sprinklers and other devices.
- B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.
- C. Carefully adjust lawn sprinklers so they will be flush with, or not more than ½-inch (13 mm) above, finish grade after completion of landscape work.
- D. Adjust settings of controllers and automatic control valves.

3.21 COMMISSIONING

- A. Starting Procedures: Follow manufacturer’s written procedures. If no procedures are prescribed by manufacturers, proceed as follows:
 - 1. Verify that specialty vales and their accessories have been installed correctly and operate correctly.
 - 2. Verify that specified test of piping are complete.
 - 3. Check that sprinklers and devices are correct type.
 - 4. Check that damaged sprinklers and devices have been replaced with new materials.
 - 5. Check that potable water supplies have correct type backflow preventers.
 - 6. Energize circuits to electrical equipment and devices.
 - 7. Adjust operating controls.
 - 8. All controller connections shall be performed by a Level III certified technician.
- B. Operational Testing: Perform operational testing after hydrostatic testing is completed, backfill is in place, and sprinklers are adjusted to final position.
- C. Provide irrigation system layout and diagram in CADD format with water zones clearly identified. Layout to be color coded with a maximum of 5 colors for easy legibility. Record water budget for each irrigation control zone and current settings. Provide laminated copy and mount near controller. Verify location with Architect.

3.22 DEMONSTRATION

- A. Demonstrate to Architect that system meets coverage requirements and that automatic controls function properly.
- B. Demonstrate to Owner's maintenance personnel operation of equipment, sprinklers, specialties, and accessories. Review operating and maintenance information.
- C. Provide 7-days' written notice in advance of demonstration.
- D. System Operation Test / Substantial Completion Inspection:
 - 1. Prior to the Substantial Completion Inspection, require the Landscape Irrigation Contractor to coordinate with the District's Irrigation Foreman to subcontract with a Certified Landscape Irrigation Auditor (hereinafter referred to as "CLIA"), at the Contractor's expense. At a pre-approved time and date, the Contractor's CLIA auditor will be directed to a location or locations specified by the District to conduct the audit. The Substantial Completion Inspection will not be authorized until the CLIA report is acceptable to the District.
 - 2. During the Substantial Completion Inspection, the entire system, both electric and hydraulic, will be tested in the presence of the Landscape Architect, the Grounds Department, and the Project Manager to insure COMPLETE coverage of all areas to be watered. This test must be performed by using a TRC Commander, hand held radio. Any deficiencies identified at this time will require revisions by the Contractor at the Contractor's expense.

3.23 WINTERIZATION

- A. All irrigation systems at the District are winterized October 15th. If the Substantial Completion Certificate has not been issued by this date, it will be the responsibility of the Contractor to winterize the system. All work shall be coordinated with and at the direction of the District Grounds Department Sprinkler Shop to winterize the system. The Contractor shall be responsible to activate the system in the Spring to insure there are no problems. Start up and Shut down will be completed in the presence of the Grounds Department Personnel. No Exceptions.

APPENDIX A
 ALLOWABLE AVERAGE DISTANCES FROM CONTROLLER TO VALVES

Wire Sizes			8 WATT NO. 50 AND 150 22" - 3" NUMBER OF VALVES				7 WATT NO. 150 SERIES NUMBER OF VALVES				3.5 WATT NO. 50 / 150 NUMBER OF VALVES				3.1 WATT NO. 1825 / 1830 SERIES NUMBER OF VALVES			
L o a d	C o m m o n	C o n t r o l l e r t o v a l v e	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
			105V	16	16	1,440	720	480	360	1,630	810	540	400	4,950	2,470	1,650	1,230	3,050
	16	14	1,770	880	590	440	2,000	1,000	680	500	6,070	3,030	2,020	1,510	3,750	1,870	1,250	930
	16	12	2,070	1,030	690	510	2,340	1,170	780	580	7,090	3,540	2,360	1,770	4,370	2,180	1,450	1,090
	14	14	2,295	1,140	760	570	2,590	1,290	860	640	7,850	3,920	2,610	1,960	4,840	2,420	1,450	1,210
	14	12	2,820	1,410	930	700	3,190	1,590	1,060	790	9,640	4,820	3,210	2,410	5,950	2,970	1,980	1,480
	14	10	3,295	1,640	1,095	820	3,720	1,860	1,230	930	11,250	5,620	3,740	2,810	6,940	3,470	2,310	1,730
	12	12	3,660	1,830	1,215	910	4,130	2,060	1,370	1,030	12,500	6,250	4,160	3,120	7,710	3,850	2,560	1,920
	12	10	4,490	2,240	1,490	1,120	5,070	2,530	1,680	1,260	15,340	7,670	5,100	3,830	9,470	4,730	3,150	2,360
	10	10	5,810	2,900	1,930	1,450	6,560	3,280	2,160	1,640	19,860	9,930	6,610	4,960	12,600	6,300	4,080	3,060
	10	8	7,140	3,570	2,370	1,780	8,060	4,030	2,650	2,010	24,390	12,190	8,120	6,090	15,050	7,520	5,010	3,760
110V	16	16	1,670	830	550	410	1,910	950	630	470	5,400	2,700	1,800	1,350	2,360	1,180	780	590
	16	14	2,050	1,020	680	510	2,350	1,170	780	580	6,630	3,310	2,210	1,650	4,160	2,080	1,380	1,040
	16	12	2,400	1,200	800	600	2,740	1,370	910	680	7,740	3,870	2,580	1,930	4,860	2,430	1,620	1,210
	14	14	2,660	1,330	880	660	3,040	1,520	1,010	760	8,570	4,280	2,850	2,140	5,380	2,690	1,790	1,340
	14	12	3,260	1,630	1,080	810	3,730	1,860	1,240	930	10,500	5,250	3,500	2,620	6,610	3,300	2,200	1,650
	14	10	3,810	1,900	1,270	950	4,350	2,170	1,450	1,080	12,280	6,140	4,090	3,070	7,710	3,850	2,570	1,920
	12	12	4,230	2,110	1,410	1,050	4,830	2,410	1,610	1,200	13,640	6,820	4,540	3,400	8,570	4,280	2,850	2,140
	12	10	5,190	2,590	1,730	1,290	5,930	2,960	1,970	1,480	16,750	8,370	5,580	4,180	10,520	5,260	3,500	2,630
	10	10	6,720	3,360	2,240	1,680	7,660	3,830	2,550	1,910	21,680	10,800	7,220	5,420	13,620	6,810	4,540	3,400
	10	8	8,260	4,130	2,750	2,010	9,420	4,710	3,140	2,350	26,620	13,300	8,870	6,650	16,720	8,360	5,570	4,180
115V	16	16	1,960	980	650	490	2,260	1,130	750	560	5,980	2,990	1,990	1,490	3,900	1,950	1,300	970
	16	14	2,410	1,200	800	600	2,780	1,390	920	690	7,340	3,670	2,440	1,830	4,790	2,390	1,590	1,190
	16	12	2,810	1,400	930	700	3,240	1,620	1,080	810	8,570	4,280	2,850	2,140	5,590	2,790	1,860	1,390
	14	14	3,120	1,560	1,030	780	3,590	1,790	1,190	890	9,480	4,740	3,150	2,370	6,180	3,090	2,050	1,540
	14	12	3,830	1,910	1,270	950	4,410	2,200	1,470	1,100	11,650	5,820	3,980	2,910	7,800	3,900	2,530	1,900
	14	10	4,470	2,230	1,480	1,110	5,150	2,520	1,710	1,280	13,600	6,800	4,520	3,400	8,870	4,430	2,950	2,210
	12	12	4,960	2,480	1,650	1,240	5,720	2,860	1,900	1,430	15,100	7,550	5,020	3,770	9,860	4,930	3,280	2,460
	12	10	6,890	3,040	2,020	1,520	7,020	3,510	2,330	1,750	18,540	9,270	6,170	4,630	12,100	6,050	4,030	3,020
	10	10	7,890	3,940	2,620	1,970	9,090	4,540	3,020	2,270	24,000	12,000	7,990	6,000	15,660	7,830	5,210	3,910
	10	8	9,690	4,840	3,220	2,420	11,160	5,580	3,710	2,790	29,470	14,730	9,810	7,360	19,230	9,610	6,400	4,800
	16	16	2,170	1,080	720	540	2,510	1,250	830	620	6,394	3,190	2,130	1,590	4,240	2,120	1,410	1,060
	16	14	2,660	1,330	880	660	3,090	1,540	1,030	770	7,850	3,920	2,710	1,960	5,200	2,600	1,730	1,300

Note: This irrigation schedule should be used as a guide. The landscaping should be monitored regularly and the schedule adjusted as needed for plant growth, local rainfall, and climate conditions. Check irrigation system frequently to minimize run off and over-spray. Schedule valves with sprinklers to irrigate between 6 PM and 10:00 AM to reduce water loss from wind and evaporation.

Jul	Month
15	Run time (minutes per day)
3	Run time (Days per week)

END OF SECTION 328400

SECTION 329113 - SOIL PREPARATION

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 planting soils and layered soil assemblies specified by composition of the mixes.
- B. Related Requirements:
 - 1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
 - 2. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.
 - 3. Section 329300 "Plants" for placing planting soil for plantings.

1.3 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.
- H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

- J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- M. SSSA: Soil Science Society of America.
- N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- Q. USCC: U.S. Composting Council.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for application and use.
 - 2. Include test data substantiating that products comply with requirements.
 - 3. Include sieve analyses for aggregate materials.
 - 4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
 - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
 - c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.
- B. Samples: For each bulk-supplied material, 1-gal. volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.6 INFORMATIONAL SUBMITTALS

- A. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

1.7 QUALITY ASSURANCE

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil imported soil.
 - 1. Notify Architect seven 3 days in advance of the dates and times when laboratory samples will be taken.
- B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
 - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.9 SOIL-SAMPLING REQUIREMENTS

- A. General: Extract soil samples according to requirements in this article.
- B. Sample Collection and Labeling: Have samples taken and labeled by soil scientist (CPSS) certified by SSSA soil classifier (CPSC) certified by SSSA soil scientist (RPSS) registered by the National Society of Consulting Soil Scientists or state-certified, -licensed, or -registered soil scientist under the direction of the testing agency.
 - 1. Number and Location of Samples: Minimum of three representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.
 - 2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
 - 3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
 - 4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.10 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:
 - 1. Soil Texture: Soil-particle, size-distribution analysis by the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

- a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.
- C. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT WERA-103, including the following:
1. Percentage of organic matter.
 2. Soil reaction (acidity/alkalinity pH value).
 3. Nitrogen ppm.
 4. Phosphorous ppm.
 5. Potassium ppm.
 6. Sodium ppm and sodium absorption ratio.
 7. Soluble-salts ppm.
 8. Other deleterious materials, including their characteristics and content of each.
- D. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
- E. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.
 2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.
- 1.11 DELIVERY, STORAGE, AND HANDLING
- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Do not move or handle materials when they are wet or frozen.
 4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

2.2 PLANTING SOILS SPECIFIED BY COMPOSITION

- A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.
- B. Planting-Soil Type : Imported, naturally formed soil from off-site sources and consisting of sandy loam, loam, silt loam or soil according to USDA textures; and modified to produce viable planting soil.
 - 1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and brome grass.
 - 2. Additional Properties of Imported Soil before Amending: Soil reaction of pH 5.0 to 8.2 and minimum of 2 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
 - 3. Unacceptable Properties: Clean soil of the following:
 - a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
 - b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 5 percent by dry weight of the imported soil.
 - c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches 3 inches in any dimension.
- C. Planting-Soil Type: Manufactured soil consisting of manufacturer's basic topsoil, sandy loam according to USDA textures, blended in a manufacturing facility with sand, stabilized organic soil amendments, and other materials to produce viable planting soil.
 - 1. Additional Properties of Manufacturer's Basic Soil before Amending: Soil reaction of pH 5 to 8.2 and minimum of 2 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
 - 2. Unacceptable Properties: Manufactured soil shall not contain the following:
 - a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
 - b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 5 percent by dry weight of the manufactured soil.
 - c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 1-1/2 inches in any dimension.

2.3 INORGANIC SOIL AMENDMENTS

- A. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.
- B. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

2.4 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
 - 1. Feedstock: May include animal waste.
 - 2. Reaction: pH 5.0 to 8.2.
 - 3. Soluble-Salt Concentration: Less than 4 dS/m.
 - 4. Moisture Content: 35 to 55 percent by weight.
 - 5. Organic-Matter Content: 50 to 60 percent of dry weight.
 - 6. Particle Size: Minimum of 98 percent passing through a 1-inch sieve.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.
- C. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
 - 1. Partially Decomposed Wood Derivatives: In lieu of shredded and composted wood derivatives, mix shredded and partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

2.5 FERTILIZERS

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

PART 3 - EXECUTION

3.1 GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

- A. Excavation: Excavate soil from designated area(s) to a depth of 12 inches and stockpile until amended.
- B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
- C. Unsuitable Materials: Clean soil to contain a maximum of 5 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.
- D. Screening: Pass unamended soil through a 1-1/2 inch sieve to remove large materials.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.
- C. Mixing: Spread unamended soil to total depth of 6 inches, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
 - 1. Amendments: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.
 - a. Mix fertilizer with planting soil no more than seven days before planting.
 - 2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

- D. Compaction: Compact each blended lift of planting soil to 85 percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply manufactured soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply approximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.
- C. Application: Spread planting soil to total depth indicated on Drawings, but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
 - 1. Lifts: Apply planting soil in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698 except where a different compaction value is indicated on Drawings.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.5 APPLYING COMPOST TO SURFACE OF PLANTING SOIL

- A. Application: Apply compost component of planting-soil mix to surface of in-place planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Finish Grading: Grade surface to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Soil will be considered defective if it does not pass tests.
- C. Prepare test reports.
- D. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.7 PROTECTION

- A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Vehicle traffic.
 - 4. Foot traffic.
 - 5. Erection of sheds or structures.
 - 6. Impoundment of water.
 - 7. Excavation or other digging unless otherwise indicated.
- C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

3.8 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
 - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 329113

SECTION 329250 – LANDSCAPE RESTORATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Replanting unsatisfactory or damaged lawns caused by contractor's operations.
 - 2. Repair to existing irrigation systems damaged by contractors' operations.
- B. Related Sections include the following:
 - 1. Division 1 Section: "Execution" for repair of paving, walks and curbs damaged by the Work.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for the following:
 - 1. Fertilizers.
- C. Certification of grass seed from sod vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 1. Certification of each seed mixture for sod, identifying sod source, including name and telephone number of supplier.
 - 2. Certification of each seed mixture of the native seed mix, identifying sod source, including name and telephone number of supplier.
- D. Certification by product manufacturer that the following products supplied comply with requirements:
 - 1. Fertilizers.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful grass establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that grass planting is in progress.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to the requirements of the American Sod Producers Association's (ASPA) "Specifications for Turfgrass Sod Materials and Transplanting/Installing."

1.6 COORDINATION AND SCHEDULING

A. Planting Season: Sow lawn seed and install sod during normal planting seasons for type of lawn work required. Correlate planting with specified maintenance periods to provide required maintenance from date of Substantial Completion.

B. Weather Limitations: Proceed with planting only when existing and forecast weather conditions are suitable for work.

1.7 MAINTENANCE

A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Sodded Lawns: 40 days after date of Substantial Completion.

B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare eroded or damaged areas to produce a uniformly smooth lawn.

1. Sod bare or damaged areas with same materials specified for lawns.

2. Utilize existing irrigation systems to keep lawns uniformly moist to a depth of 4 inches (100 mm).

3. Water lawn at the minimum rate of 1 inch (25 mm) per week.

C. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain following grass height:

1. Mow grass from 3 to 4 inches high.

D. Pre-fertilization: Apply fertilizer to soil and rake in 24 hours prior to planting sod.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of lawn area.

- E. Postfertilization: Apply fertilizer to lawn after first mowing and when grass is dry.
 - 1. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of lawn area.

PART 2 - PRODUCTS

2.1 SOD

- A. Sod: Certified turfgrass sod complying with ASPA specifications for machine-cut thickness, size, strength, moisture content, and mowed height, and free of weeds and undesirable native grasses. Provide viable sod of uniform density, color, and texture of the following turfgrass species, strongly rooted, and capable of vigorous growth and development when planted.
 - 1. Species: Provide sod of grass species and varieties, to match existing stand of grass

2.2 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 8, 2 percent organic material minimum, free of stones 1/4 inch (6.35 mm) or larger in any dimension, and other extraneous materials harmful to plant growth.
 - 1. Topsoil Source: Topsoil shall be Imported onto the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

2.3 FERTILIZER

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb. per 1000 sq. ft. (0.5 kg per 100 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

2.4 IRRIGATION SYSTEM

- A. Description: Manufacturer's standard sprinklers designed to provide uniform coverage over entire area of spray to match existing in place at available water pressure, as follows:
 - 1. Housings: Plastic, except where material is specified.
 - 2. Pop-up, Spray: Fixed pattern, with screw-type flow adjustment and stainless steel retraction spring.
 - 3. Pop-up, Rotary Spray: Gear drive, full-circle and adjustable part-circle type.

- B. Branches and Offsets at Sprinkler and Devices: ASTM D 1785, Schedule 80, polyvinyl chloride (PVC) plastic pipe with threaded ends; ASTM D 2464, Schedule 80, PVC plastic, threaded fittings; and threaded joints. To match existing sizes in place.
- C. Polyvinyl Chloride (PVC) Piping Solvent-Cemented Joints: Construction joints according to ASTM D 2672 and ASTM D 2855.
 - 1. Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F 402 for safe handling when joining plastic pipe and fittings with solvent cements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive lawns and grass for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

3.3 PLANTING SOIL PREPARATION

- A. Limit subgrade preparation to areas that will be planted in the immediate future.
- B. Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1/2 inch in any dimension and sticks, roots, rubbish, and other extraneous matter.
- C. Mix soil amendments and fertilizers with topsoil at rates indicated. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days. Either mix soil before spreading or apply soil amendments on surface of spread topsoil and mix thoroughly into top 4 inches (100 mm) of topsoil before planting.
- D. Spread planting soil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen.
 - 1. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.
 - 2. Allow for sod thickness in areas to be sodded.
- E. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches (38 mm) in any dimension, and other objects that may interfere with planting or maintenance operations.

- F. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- G. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.4 IRRIGATION PIPING REPAIR

- A. Trenches shall be dug as wide and deep as necessary to properly replace the sprinkling system. Any rock uncovered in this excavation shall not be left in the backfill. All excess rock shall be removed from the site by this Contractor and legally disposed of off the property. All trenches shall be backfilled and compacted to insure no settling of the surface, after the lawn is planted.
- B. Sprinklers: Flush circuit piping with full head of water and install sprinklers after hydrostatic test of the disturbed system is complete.
 - 1. Install lawn sprinklers at manufacturer's recommended heights.
 - 2. Install shrubbery sprinklers at heights indicated.
 - 3. Locate part-circle sprinklers to maintain a minimum distance of 12-inches (400 mm) from walls and 2-inches (50 mm) from other boundaries, unless otherwise indicated.

3.5 SODDING

- A. In areas of excavation immediately adjacent to the new structure, provide the following:
- B. Lay sod within 24 hours of stripping. Do not lay sod if dormant or if ground is frozen.
- C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across angle of slopes exceeding 1:3.
- D. Saturate sod with fine water spray within 2 hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below the sod.

3.6 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto surface of roads, walks, or other paved areas.
- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period until lawn is established.

END OF SECTION 329250

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plant materials.
2. Fertilizers.
3. Root barriers.
4. Mulches.
5. Herbicides and pesticides.
6. Tree-stabilization materials.
7. Landscape edgings.
8. Tree grates.
9. Tree-watering devices.

B. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 31 2200 - Grading: Topsoil material.
3. Section 31 2323 - Fill: Topsoil material.
4. Section 32 0190 - Operation and Maintenance of Planting: Post-occupancy maintenance.
5. Section 328400 "Planting Irrigation" for complete irrigation systems.
6. Section 32 9116: "Mulching"
7. Section 32 9119: "Topsoil Placement and Grading" installation of top soil.
8. Section 329219 "Seeding" for planting, hydroseeding, and erosion-control materials.
9. Section 329220 "Sodding" for turf (lawn)

C. Reference Standards:

1. American Nursery & Landscape Association / American National Standards Institute: ANLA / ANSI Z60.1-2004, 'American Standard for Nursery Stock.'
2. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Pruning).

1.2 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.

1.4 ACTION SUBMITTALS

- A. Product Data:

1. Plant materials.
 - a. Photos: Provide photos of plant materials for approval prior to purchase and installation.
 - b. Certificate: Submit certificate for plants free of disease or hazardous insects; certified by federal department of agriculture; free of disease or hazardous insects.
2. Fertilizers.
3. Root barriers.
4. Herbicides and pesticides.
5. Tree-stabilization materials.

- B. Product Data Submittals: For each product.

1. Plant Materials: Include quantities, sizes, quality, and verified sources for plant materials.

- C. Samples for Verification: Actual sample of finished products for each of the following:

1. Organic Mulch: **1-pint (0.5-L)** volume of each organic mulch required; typical of the lot of material to be furnished, in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Provide an accurate representation of color, texture, and organic makeup.
2. Mineral Mulch: **2 lb (1.0 kg)** of each mineral mulch required; typical of the lot of material to be furnished, in sealed plastic bags labeled with source of mulch. Provide accurate indication of color, texture, and makeup.
3. Proprietary Root-Ball-Stabilization Device: One unit.
4. Root Barrier: Width of panel by **12 inches (300 mm)**.

1.5 INFORMATIONAL SUBMITTALS

- A. Field Quality-Control Reports: Percolation tests for tree pits. Include the following:

1. Tree identification number matching the plans.
2. Date of test.
3. Time when water was added to tree pit to start percolation test.
4. Time with photo documentation showing increments of testing with water level in tree pit.
5. Identification of tester.

- B. Qualification Statements: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

- C. Product Certificates: For each type of manufactured product, from manufacturer, and complying with manufacturer's certified analysis of standard products.

- D. Pesticides and Herbicides: Product label and manufacturer's written application instructions specific to Project.
- E. Maintenance Contract.
- F. Maintenance Data: Include cutting and trimming method; types, application frequency, and recommended coverage of fertilizer.
- G. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
 - 1. Experience: **Five** years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
 - 2. Installer's Field Supervision: Maintain an experienced full-time supervisor on Project site when work is in progress.
 - 3. Personnel Certification: Installer's **field supervisor** certified in **[one]** **[all]** of the following categories from the National Association of Landscape Professionals:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Horticultural Technician.
- B. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.
- C. Tree Pruning: Conform to ANSI A300 Part 1.
- D. Maintenance Services: Performed by installer.
- E. Pesticide Applicator: State licensed, commercial.
- F. Non-native, Invasive Plant Species: Do not introduce, grow, or cultivate plant species that are non-native to the ecosystem of the project site, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
 - 1. Conform to laws regulating non-native and invasive plant species in Utah.
- G. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- H. Measurements: Measure in accordance with ANSI Z60.1. Do not prune to obtain required sizes.
 - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements **6 inches (150 mm)**

- above the root flare for trees up to **4-inch (100-mm)** caliper size, and **12 inches (300 mm)** above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
 3. Measurement should be average of plant, not greatest diameter. For example, plant measuring 15 inches in widest direction and 9 inches in narrowest would be classified as 12 inch stock.
 4. Plants properly trimmed and transplanted should measure same in every direction.
 5. Where caliper or other dimensions of plant materials are omitted from Plant List, plant materials shall be normal stock for type listed.
- I. Shape and Form:
1. Plant materials shall be symmetrical or typical for variety and species and conform to measurements specified in Plant List.
 2. Well grown material will generally have height equal to or greater than spread. However, spread shall not be less than 2/3 of height.
- J. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Architect of sources of planting materials a minimum of **seven** days in advance of delivery to site.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, or walkways and pavements; or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk materials with appropriate certificates.
- C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- D. Handle planting stock by root ball or container. Do not drop trees and shrubs during delivery.
- E. Store bulbs, corms, and tubers in a dry place at **60 to 65 deg F (16 to 18 deg C)** until planting.

Retain one of first two paragraphs below; revise to suit Project.

- F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
 - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- G. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- H. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
 - 1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
 - 2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 3. Do not remove container-grown stock from containers before time of planting.
 - 4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions in accordance with manufacturer's written instructions and warranty requirements.
 - 1. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 105 degrees F.
 - 2. Do not install plant life when wind velocity exceeds 30 mph.

1.10 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
 - b. Structural failures, including plantings falling or blowing over.
 - c. Faulty performance of **tree stabilization**.

- d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Periods: From date of **Substantial Completion**.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: **12**months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: **12**months.
 - c. Annuals: **Three** months.
3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
 - d. Replacements: Plants of same size and species as specified, planted in the next growing season.
 - e. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.11 WARRANTY PERIOD MAINTENANCE PLAN

- A. Provide written instructions and training to Owner covering maintenance requirements for first year of operation after landscape installation is accepted as complete. Submit instructions to Architect for inclusion in the Temple Site Management Plan. Contractor to submit written instructions to Owner's representative and Architect for approval prior to final inspection and approval.
 1. Provide instructions for Owner's maintenance personnel to contact the installing contractor immediately should there be any warranty issues (such as unhealthy plants or irrigation issues) or other items of concern that fall under the installing contractor's warranty - all warranty items are the installing contractor's responsibility during the maintenance period.
- B. Plan shall include the following items:
 1. Contact Information
 2. Irrigation - Hose Watering (Hose Bib/Quick Coupler)
 - a. Schedule (Adjusted as needed for seasonal changes and for plant establishment schedules)
 - b. Start-up Instructions
 3. Fertilization Instructions:
 - a. Type
 - b. Quantity
 - c. Schedule
 4. Pest/Disease Control
 5. Lawn Care
 - a. Mow Height
 - b. Mow Frequency
 6. Tree/Shrub Pruning
 - a. Schedule/Timing
 - b. Method of Pruning
 - c. Pruning Type
 - 1) Formal

- 2) Informal
 7. Other items as deemed necessary for the project.
- C. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
1. Trees with damaged, crooked, or multiple leaders; with tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); with crossing trunks; with cut-off limbs more than **3/4 inch (19 mm)** in diameter; or with stem girdling roots are unacceptable.
 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
 3. Do not prune plants or top trees prior to delivery.
 4. Plant materials shall be subject to approval by Architect as to size, health, quality, and character.
 5. Bare root trees are not acceptable.
 6. Provide plant materials from licensed nursery or grower. All products/plants listed must be verified as locally available. Minimize/avoid importing. Where no exact match is available contractor to present substitution options.
- B. Nomenclature: Plant names used in Plant List conform to 'Standardized Plant Names' by American Joint Committee on Horticultural Nomenclature except in cases not covered. In these instances, follow custom of local nursery trade.
- C. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- D. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare in accordance with ANSI Z60.1.
- E. Labeling: Label **at least 10 percent of** plants of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for plant.
- F. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to ensure symmetry in planting.
- G. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm

ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

- H. Plant materials larger than those specified may be supplied, with prior written approval of Architect, and:
 - 1. If complying with Contract Document requirements in all other respects.
 - 2. If at no additional cost to Owner.
 - 3. If sizes of roots or balls are increased proportionately.

2.2 FERTILIZERS

- A. Granular Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition:
 - a. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- B. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb (0.45 kg) of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb (0.45 kg) of ectomycorrhizal fungi, 33 percent hydrogel, and maximum of 5.5 percent inert material.
- C. Planting Tablets: 21 gram Agriform 20 10 5. (Or Equal as approved by Architect before installation.)
- D. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.
- E. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.
- F. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of plants.

2.3 WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101 g/sq. m) minimum, composed of fibers inert to biological degradation and naturally resistant to chemicals, alkalis, and acids, formed into a stable network so that fibers retain their relative position.
- B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd. (162 g/sq. m).

2.4 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Western Red Cedar species wood shavings, free of growth or germination inhibiting ingredients.
2. Size Range: **3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.**
3. Color: Natural.

- B. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of the following type, size range, and color:

1. Type: **Crushed stone .**
2. Size Range: **[1-1/2 inches (38 mm) maximum, 3/4 inch (19 mm) minimum] [3/4 inch (19 mm) maximum, 1/4 inch (6.4 mm) minimum]**
3. Color: **Uniform tan-beige color range acceptable to Architect**

2.5 HERBICIDES AND PESTICIDES

- A. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
1. Category Four Approved Products. See Section 01 6000 for definitions of Categories
 - a. Chipco Dimension Granular by The Andersons Inc, Maumee, IL www.andersonsinc.com.
 - b. Elanco XL2G granular by Crop Data Management Systems, Marysville, CA www.cdms.net.
 - c. Ronstar G granular by Bayer CropScience, Monheim, Germany www.bayercropscience.com
 - d. Surflan AS liquid by United Phosphorous Inc, Trenton, NJ www.upi-usa.com.
 - e. Oryzalin 4 A.S. liquid by FarmSaver, Seattle, WA
- B. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

Insert requirements for other types of pesticides such as rodenticides, if required.

- C. Pesticides: Registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended in writing by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.6 TREE-STABILIZATION MATERIALS

- A. Trunk-Stabilization Materials:
1. Upright and Guy Stakes: Rough-sawn, sound, new **hardwood** or **softwood with specified wood pressure-preservative treatment**, free of knots, holes, cross grain, and other defects, 2 inch diameter by length indicated, pointed at one end or Equal as approved by Architect before installation. See Section 01 6000.
 2. Wood Deadmen: Timbers measuring **8 inches (200 mm)** in diameter and **48 inches (1200 mm)** long, treated with specified wood pressure-preservative treatment.
 3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or.
 - a. Two Acceptable Products:
 - 1) 32 inch 800 mm Cinch-Tie tree ties by V.I.T. Products Inc, Escondido, CA

- 2) Flex strap Tree Ties by Aquarius Brands Inc, Ontario, CA www.aquariusbrands.com.
- 3) Equal as approved by Architect before installation. See Section 01 6000.
4. Guy Cables: Five-strand, **3/16-inch- (4.8-mm-)** diameter, galvanized-steel cable, with zinc-coated **turnbuckles** or **compression springs**, a minimum of **3 inches (75 mm)** long, with two **3/8-inch (10-mm)** galvanized eyebolts.
5. Flags: Standard surveyor's plastic flagging tape, white, **6 inches (150 mm)** long.
6. Proprietary Staking-and-Guying Devices: Proprietary stake or anchor and adjustable tie systems to secure each new planting by plant stem; sized as indicated and in accordance with manufacturer's written instructions.
 - a. Duckbill Model 68RBK or 88RBK rootball guying kit.
 - b. Equal as approved by Architect before installation. See Section 01 6000.

2.7 LANDSCAPE EDGINGS

- A. Steel Edging: Standard commercial-steel edging, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.

1. **<Double click here to find, evaluate, and insert list of manufacturers and products.>**
2. Edging Size: **[3/16 inch (4.8 mm) thick by 4 inches (100 mm) deep] [1/4 inch (6.4 mm) thick by 5 inches (125 mm) deep] [1/4 inch (6.4 mm) thick by 4 inches (100 mm) deep] [1/8 inch (3.2 mm) thick by 4 inches (100 mm) deep] [1/8 inch (3.2 mm) thick by 6 inches (150 mm) deep] [0.1 inch (2.5 mm) thick by 4 inches (100 mm) deep] <Insert dimensions>**.
3. Stakes: Tapered steel, a minimum of **15 inches (380 mm)** long.
4. Accessories: Standard tapered ends, corners, and splicers.
5. Finish: **Manufacturer's standard paint.**
 - a. Paint Color: **Black.**

- B. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B221 (ASTM B221M), Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.

1. **<Double click here to find, evaluate, and insert list of manufacturers and products.>**
2. Edging Size: **[3/16 inch (4.8 mm) thick by 5-1/2 inches (140 mm) deep] [3/16 inch (4.8 mm) thick by 4 inches (100 mm) deep] [1/8 inch (3.2 mm) thick by 5-1/2 inches (140 mm) deep] [1/8 inch (3.2 mm) thick by 4 inches (100 mm) deep] <Insert dimensions>**.
3. Stakes: Aluminum, ASTM B221 (ASTM B221M), Alloy 6061-T6, approximately 1-1/2 inches (38 mm) wide by 12 inches (300 mm) long.
4. Finish: **Black anodized.**

2.8 TREE GRATES

- A. Tree Grates: Manufacturer's **[standard] [custom designed] tree grates [and frames]**.

1. **<Double click here to find, evaluate, and insert list of manufacturers and products.>**
2. Grates: ASTM A48/A48M, Class 35 (Class 250) or better, gray-iron castings.
3. Frames: **[ASTM A48/A48M, Class 35 (Class 250) or better, gray-iron castings] [or] [ASTM A36/A36M steel-angle, hot-dip galvanized,] of shape, pattern, and size indicated.**

B. Shape and Size: [As indicated on Drawings] [Round, 36 inches (914 mm) in diameter] [Round, 72 inches (1828 mm) in diameter] [48 inches (1219 mm) square] [60 inches (1524 mm) square] [Rectangular, 36 by 60 inches (914 by 1524 mm)] [Rectangular, 48 by 72 inches (1219 by 1828 mm)] <Insert shape and dimensions>.

C. Finish: Powder-coat finish.

1. Color: Low-gloss black .

2.9 TREE-WATERING DEVICES

A. Watering Pipe: PVC pipe 4 inches (100 mm) in diameter, site-cut to length as required, and with snug-fitting removable cap.

B. Slow-Release Watering Device: Standard product manufactured for drip irrigation of plants and emptying its water contents over [an extended time period] [two to nine hours] [two to three weeks] <Insert number or range>; manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

Retain "Color" Subparagraph below if required. Available colors vary with manufacturer and product.

2. Color: [As selected by Architect from manufacturer's full range] [black] [dark chocolate] [green] [or] [tan] <Insert color>.

2.10 MISCELLANEOUS PRODUCTS

A. Root Barrier: Black, molded, modular panels 18 inches (457 mm) high (deep), 85 mils (2.2 mm) thick, and with vertical root deflecting ribs protruding 3/4 inch (19 mm) out from panel surface; manufactured with minimum 50 percent recycled polyethylene plastic with UV inhibitors.

1. DeepRoot Green Infrastructure, LLC

a. UB 18-2

2. Equal as approved by Architect before installation. See Section 01 6000.

B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix in accordance with manufacturer's written instructions.

C. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D448 for Size No. 8.

D. Planter Filter Fabric: Nonwoven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before proceeding with work, check and verify dimensions and quantities. Report variations between Drawings and site to Architect before proceeding with work of this Section.

- B. Plant totals are for convenience only and are not guaranteed. Verify amounts shown on Drawings. All planting indicated on Drawings is required unless indicated otherwise.
- C. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
 - 3. Suspend planting operations during periods of excessive soil moisture until moisture content reaches acceptable levels to attain required results.
 - 4. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- D. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove soil and contamination as directed by Architect and replace with new planting soil.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil in accordance with **Section 329113 "Soil Preparation."**
- B. Placing Planting Soil: **Place and mix planting soil in-place over exposed subgrade.**
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate **in accordance with manufacturer's written instructions.**

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 2. Excavate approximately three times as wide as ball diameter for **balled and burlapped**, **balled and potted**, **container-grown**, or **fabric bag-grown** stock.
 3. Do not excavate deeper than depth of root ball, measured from the root flare to the bottom of root ball.
 4. If area under the plant was initially dug too deep, add soil to raise it to correct level and thoroughly tamp the added soil to prevent settling.
 5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 6. Maintain supervision of excavations during working hours.
 7. Keep excavations covered or otherwise protected **after working hours**.
- B. Backfill Soil: Unless excavated material meets topsoil requirements as specified in Section 31 9113, remove from landscape areas and do not use for landscaping purposes.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations. If underground construction work or obstructions are encountered in excavation of planting holes, Architect will select alternate locations.
1. Hardpan Layer: Drill **6-inch- (150-mm-)** diameter holes, **24 inches (600 mm)** apart, into free-draining strata or to depth of **10 ft. (3 m)**, whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.
1. Water Percolation Test:
 - a. Before planting, select five typical planting excavations throughout the site. Fill each hole with water and verify that water drains away at a rate of 3 inches per hour or greater. Inform Architect in writing if water does not drain properly. Do not plant trees or shrubs in holes that do not properly drain.
 - b. For plant pits that do not drain properly auger 6 inch diameter hole 4 feet deep in low point of each excavation and fill with tamped planting mix.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball in accordance with ANSI Z60.1. If root flare is not visible, remove soil in a level manner from root ball to where the top-most root emerges from the trunk. After soil removal to expose root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

- C. Plant immediately after removing binding material and containers.
- D. **Balled and Burlapped Stock:** Set each plant plumb and in center of planting pit or trench, except in heavy clay soils, make ring of mounded soil around the hole perimeter to form watering basin, with shrub root flares **1 inch (25 mm) above** and tree root flares **2 inches (50 mm) above** adjacent finish grades.
1. Backfill: Planting soil.
 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove top one / third of wire basket and burlap binders from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 3. Remove plastic and twine binders from around root ball and tree trunk.
 4. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 5. Distribute granular fertilizer around each planting pit when pit is approximately one-half filled. Do not place in bottom of the hole. Place tablets in relation to root ball as recommended by Manufacturer.
 - a. Quantity:
 - 1) One Gallon Shrub: 1 tablet.
 - 2) 5 Gallon Shrub / Tree: 3 tablets.
 - 3) 15 Gallon Tree: 4 tablets.
 - 4) 24-inch Box Tree: 6 Tablets.
 6. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. **Balled and Potted and Container-Grown Stock:** Set each plant plumb and in center of planting pit or trench with shrub root flares **1 inch (25 mm) above** and tree root flares **2 inches (50 mm) above** adjacent finish grades.
1. Backfill: Planting soil.
 2. Carefully remove root ball from container without damaging root ball or plant.
 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 4. Distribute granular fertilizer around each planting pit when pit is approximately one-half filled. Do not place in bottom of the hole.
 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- F. **Fabric Bag-Grown Stock:** Set each plant plumb and in center of planting pit or trench with shrub root flares **1 inch (25 mm) above** and tree root flares **2 inches (50 mm) above** adjacent finish grades.
1. Backfill: Planting soil
 2. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 4. Distribute granular fertilizer around each planting pit when pit is approximately one-half filled. Do not place in bottom of the hole.
 5. Continue backfilling process. Water again after placing and tamping final layer of soil.

- G. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of root ball.
- H. Do not use muddy soil for backfilling.
- I. Make adjustments in positions of plants as directed by Architect.
- J. Thoroughly water trees and shrubs immediately after planting.
- K. At base of each tree, leave 36-inch diameter circle free of any grass
- L. Drawings and specifications to guide plant installation wherever possible/appropriate. Follow local installation practices when/where deemed appropriate. Any changes to installation as shown in the details and outlined in spec's to be approved by Landscape Architect/Owner Representative prior to implementation.

3.6 TREE, SHRUB, AND VINE PRUNING

- A. Prune trees as recommended in ANSI A300 Part 1.
- B. Remove only dead, dying, or broken branches. Do not prune for shape.
- C. Do not apply pruning paint to wounds.

3.7 INSTALLATION OF TREE-STABILIZATION MATERIALS

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
 - 1. Upright Staking and Tying:
 - a. Stake trees of **2- through 5-inch (50- through 125-mm)** caliper. Stake trees of less than **2-inch (50-mm)** caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least **18 inches (450 mm)** below bottom of backfilled excavation and to **at least 6 inches below main tree canopy**. Set vertical stakes and space to avoid penetrating root balls or root masses.
 - b. Stake trees with two stakes for trees up to 12 ft. (3.6 m) high and 2-1/2 inches (63 mm) or less in caliper; three stakes for trees less than 14 ft. (4.2 m) high and up to 4 inches (100 mm) in caliper. Space stakes equally around trees.
 - 2. Place tree ties 6 to 12 inches below crotch of main tree canopy. Second set of tree ties may be required 18 to 24 inches above finish grade, if directed by Architect. Allow enough slack to avoid rigid restraint of tree.
- B. Trunk Stabilization by Staking and Guying: Install trunk stabilization as follows unless otherwise indicated on Drawings. Stake and guy trees more than **14 ft. (4.2 m)** in height and more than **3 inches (75 mm)** in caliper or 36 inch box unless otherwise indicated.
 - 1. Site-Fabricated, Staking-and-Guying Method: Install no fewer than three guys spaced equally around tree.

- a. Securely attach guys to stakes **30 inches (760 mm)** long, driven to grade. Adjust spacing to avoid penetrating root balls or root masses. Provide **compression spring** for each guy wire and tighten securely.
 - b. For trees more than **6 inches (150 mm) in caliper**, anchor guys to wood deadmen buried at least **36 inches (900 mm)** below grade. Provide compression **spring** for each guy wire and tighten securely.
 - c. Support trees with bands of flexible ties at contact points with tree trunk and reaching to **compression spring**. Allow enough slack to avoid rigid restraint of tree.
 - d. Attach flags to each guy wire, **30 inches (760 mm)** above finish grade.
2. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and in accordance with manufacturer's written instructions.
- C. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by root ball unless otherwise indicated.
1. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and in accordance with manufacturer's written instructions.

3.8 INSTALLATION OF ROOT BARRIER

- A. Install root barrier where trees are planted within **60 inches (1500 mm)** of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.
- B. Align root barrier **vertically**, and run it linearly along and adjacent to paving or other hardscape elements to be protected from invasive roots.
- C. Install root barrier continuously for distance of **60 inches (1500 mm)** in each direction from tree trunk, for total distance of **10 ft. (3 m)** per tree. If trees are spaced closer, use single continuous piece of root barrier.
 1. Position top of root barrier **flush with finish grade**.
 2. Overlap root barrier minimum of **12 inches (300 mm)** at joints.
 3. Do not distort or bend root barrier during construction activities.
 4. Do not install root barrier surrounding the root ball of tree.

3.9 PLACING SOIL IN PLANTERS

- A. Place a layer of drainage gravel at least **4 inches (100 mm)** thick in bottom of planter. Cover bottom with filter fabric and wrap filter fabric **4 inches (100 mm)** up on all sides. Duct tape along the entire top edge of filter fabric, to secure filter fabric against the sides during soil-filling process.
- B. Fill planter with planting soil. Place soil in lightly compacted layers to elevation of **1-1/2 inches (38 mm)** below top of planter, allowing natural settlement.

3.10 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines **as indicated on Drawings** in even rows with triangular spacing.
- B. Vines: Remove from stakes, untie, and securely fasten to wall or fence next to which they are planted.
- C. Ground Covers: Container-grown unless otherwise specified on Drawings.
- D. Use planting soil for backfill.
- E. Dig holes large enough to allow spreading of roots.
- F. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to depth not less than two nodes.
- G. Work soil around roots to eliminate air pockets and leave slight saucer indentation around plants to hold water.
- H. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- I. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.11 INSTALLATION OF MULCHES

- A. Install weed-control barriers before mulching in accordance with manufacturer's written instructions. Completely cover area to be mulched, overlapping edges minimum of **12 inches (300 mm)**, and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees and Treelike Shrubs in Turf Areas: Apply **organic** mulch ring of **3-inch (75-mm)** average thickness, with **36-inch (900-mm)** radius around trunks or stems. Do not create a mulch cone or place mulch within **3 inches (75 mm)** of trunks or stems.
 - 2. Organic Mulch in Planting Areas indicated on the drawings: Apply **3-inch (75-mm)** average thickness of organic mulch **over whole surface of planting area**, and finish level with adjacent finish grades. Do not place mulch within **3 inches (75 mm)** [**6 inches (150 mm)**] of trunks or stems.
 - 3. Mineral Mulch in Planting Areas indicated on the drawings: Apply **3-inch (75-mm)** average thickness of mineral mulch **over whole surface of planting area**, and finish level with adjacent finish grades. Do not place mulch within **3 inches (75 mm)**.

3.12 INSTALLATION OF LANDSCAPE EDGINGS

- A. Steel Edging: Install steel edging where indicated in accordance with manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.

- B. Aluminum Edging: Install aluminum edging where indicated in accordance with manufacturer's written instructions. Anchor with aluminum stakes spaced approximately **36 inches (900 mm)** apart, driven below top elevation of edging.

3.13 INSTALLATION OF TREE GRATES

- A. Tree Grates: Install in accordance with manufacturer's written instructions. Set grate segments flush with adjoining surfaces. Shim from supporting substrate with soil-resistant plastic. Maintain **3-inch- (75-mm-)** minimum growth radius around base of tree; break away portions of casting, if necessary, in accordance with manufacturer's written instructions.

3.14 APPLICATION OF HERBICIDES AND PESTICIDES

- A. Apply specified pre-emergent herbicide to shrub and ground cover planting areas and grass-free areas at tree bases after completion of planting.
- B. Areas shall be free of existing weed growth prior to application of herbicide.
- C. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written instructions. Do not apply to seeded areas.
- D. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written instructions.
- E. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and in accordance with manufacturer's written instructions. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.15 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.16 FIELD QUALITY CONTROL

- A. Tests and Inspections:

1. Perform tree pit percolation tests.
2. Tree pit construction will be considered defective if it does not pass percolation tests and inspections.
3. Do not proceed with planting in tree pits until satisfactory percolation is demonstrated.

B. Prepare test and inspection reports.

3.17 REPAIR AND REPLACEMENT

A. Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Remove and replace trees that are more than **25** percent dead or in unhealthy condition **before end of corrections period** or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced for each tree of **6 inches (150 mm)** or smaller in caliper size.
2. Provide **two** new tree(s) of **4-inch (100-mm)** caliper size for each tree being replaced that measures more than **6 inches (150 mm) 4 inches (100 mm)** in caliper size.
3. Species of Replacement Trees: **Same species being replaced.**

3.18 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before **[Substantial Completion] <Insert time>**, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

END OF SECTION 329300

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
 - 1. Special fittings for expansion and deflection.
 - 2. Cleanouts.
 - 3. Drains.
 - 4. Precast concrete manholes, inlet boxes, catch basins.
 - 5. Cast in place inlet boxes and catch basins and manhole bases over existing pipes.

1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.
- B. CP: Non-reinforced concrete pipe.
- C. RCP: Reinforced concrete pipe.

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Special pipe fittings.
 - 2. Drains.
 - 3. Storage.
 - 4. Pipes.
- B. Shop Drawings: For the following:
 - 1. design calculations, and concrete design-mix report for cast-in-place manholes.

2. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.
 3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.
- C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- D. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- E. Field quality-control test reports.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
 - B. Protect pipe, pipe fittings, and seals from dirt and damage.
 - C. Handle manholes according to manufacturer's written rigging instructions.
 - D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.
- 1.7 PROJECT CONDITIONS
- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 1. Notify Architect, Construction Manager, and Owner no fewer than two days in advance of proposed interruption of service. Coordinate interruptions during weekly meetings and at pre-construction meeting.
 2. Do not proceed with interruption of service without Architect's, Construction Manager's, and Owner's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include local pre-cast manufacturers but are subject to approval of the engineer and architect.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 PVC PIPE AND FITTINGS

- A. PVC Pressure Pipe: AWWA C900, Class 150 for gasketed joints and using ASTM F 477, elastomeric seals.
 1. Fittings NPS 4 to NPS 8: PVC pressure fittings complying with AWWA C907, for gasketed joints and using ASTM F 477, elastomeric seals.
 2. Fittings NPS 10 and Larger: Ductile-iron, compact fittings complying with AWWA C153, for push-on joints and using AWWA C111, rubber gaskets.
- B. PVC Water-Service Pipe and Fittings: ASTM D 1785, Schedule 80 pipe, with plain ends for solvent-cemented joints with ASTM D 2467, Schedule 80, socket-type fittings.
- C. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness pipe with ASTM D 3034, SDR 35, socket-type fittings for solvent-cemented joints.
- D. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.
- E. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T 2 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.
- F. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.4 CONCRETE PIPE AND FITTINGS

- A. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM C 14, Class I, II or III, with bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.
- B. Piping in paragraph below is available in 5 classes and 3 wall thicknesses, and in NPS 12 to NPS 144. Not all classes and wall thicknesses are available. Joints are gasket type. Contractor, at his option, may use non-reinforced pipe for sizes up to 21-inches if structural requirements based on load on pipe are not exceeded for that pipe. If reinforced pipe is selected, choose the pipe class and wall thickness to suit availability and structural requirements based on loads and cover.
- C. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, with bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.
 1. Class I

2. Class II
3. Class III

2.5 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 1. For Concrete Pipes: ASTM C 443, rubber.
 2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 1. Manufacturers:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco Inc.
 - c. Logan Clay Products Company (The).
 - d. Mission Rubber Company; a division of MCP Industries, Inc.
 - e. NDS Inc.
 - f. Plastic Oddities, Inc.
- D. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 1. Manufacturers:
 - a. Cascade Waterworks Mfg.
 - b. Dallas Specialty & Mfg. Co.
 - c. Mission Rubber Company; a division of MCP Industries, Inc.
- E. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
 1. Manufacturers:
 - a. Fernco Inc.
 - b. Logan Clay Products Company (The).
 - c. Mission Rubber Company; a division of MCP Industries, Inc.

2.6 PRESSURE-TYPE PIPE COUPLINGS

- A. Reducing or transition, metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 150-psig minimum pressure rating and ends of same sizes as piping to be joined.
- B. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg.
 - b. Dresser, Inc.; DMD Div.
 - c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Romac Industries, Inc.
 - f. Smith-Blair, Inc.
 - g. Viking Johnson.
 - 2. Center-Sleeve Material: Manufacturer's standard.
 - 3. Gasket Material: Natural or synthetic rubber.
 - 4. Metal Component Finish: Corrosion-resistant coating or material.
- C. Split-Sleeve Couplings: With split sleeve with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
 - 1. Manufacturers:
 - a. Brico Industries.
 - 2. Sleeve Material: Manufacturer's standard.
 - 3. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
 - 4. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
 - 5. Metal Component Finish: Corrosion-resistant coating or material.

2.7 SPECIAL PIPE FITTINGS

- A. Ductile-Iron Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include 2 gasketed ball-joint sections and 1 or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.
 - 1. Manufacturers:
 - a. EBAA Iron Sales, Inc.
 - b. Romac Industries, Inc.
 - c. Star Pipe Products.
- B. Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

1. Manufacturers:

- a. EBAA Iron Sales, Inc.

- C. Ductile-Iron Expansion Joints: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated.

1. Manufacturers:

- a. Dresser, Inc.; DMD Div.
- b. EBAA Iron Sales, Inc.
- c. JCM Industries.
- d. Smith-Blair, Inc.

2.8 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Manufacturers:

- a. Josam Company.
- b. MIFAB Manufacturing, Inc.
- c. Smith, Jay R. Mfg. Co.
- d. Wade Div.; Tyler Pipe.
- e. Watts Industries, Inc.
- f. Watts Industries, Inc.; Enpoco, Inc. Div.
- g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

- 2. Top-Loading Classification(s): Light, Medium, Heavy, and Extra-heavy duty depending on location and expected driving load on cleanout.
- 3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

- B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping. Place in grey iron housing with clamping device and round, secured, scoriated, gray-iron cover.

1. Manufacturers:

- a. Canplas Inc.
- b. IPS Corporation.
- c. NDS Inc.
- d. Plastic Oddities, Inc.
- e. Sioux Chief Manufacturing Company, Inc.
- f. Zurn Industries, Inc.; Zurn Light Commercial Specialty Plumbing Products.

2.9 DRAINS

- A. Gray-Iron Area Drains: ASME A112.21.1M, round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.

1. Manufacturers:

- a. Josam Company.
- b. MIFAB Manufacturing, Inc.
- c. Smith, Jay R. Mfg. Co.
- d. Wade Div.; Tyler Pipe.
- e. Watts Industries, Inc.
- f. Watts Industries, Inc.; Enpoco, Inc. Div.
- g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

2. Top-Loading Classification(s): Medium and heavy duty depending on location and expected driving load.

- B. Gray-Iron Trench Drains: ASME A112.21.1M, 6-inch to 12-inch-wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular secured grate. Include units of total length indicated and number of bottom outlets with inside calk or spigot connections, of sizes indicated.

1. Manufacturers:

- a. Josam Company.
- b. Smith, Jay R. Mfg. Co.
- c. Wade Div.; Tyler Pipe.
- d. Watts Industries, Inc.
- e. Watts Industries, Inc.; Enpoco, Inc. Div.
- f. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
- g. Poly Drain, ABT

2. Top-Loading Classification(s): Medium, heavy, and extra-heavy duty.

2.10 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches minimum, unless otherwise indicated and as needed for pipe sizes.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 9-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 8. Steps: Not used.
 9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
 10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
 11. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
 - a. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48, Class 35 gray iron, unless otherwise indicated and to match existing manhole frames and covers.
 - b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 15-mil minimum thickness applied to all surfaces, unless otherwise indicated.
- B. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
1. Ballast: Increase thickness of concrete, as required to prevent flotation.
 2. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 3. Steps: Not used.
 4. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
 5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
 6. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
 - a. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48, Class 35 gray iron, unless otherwise indicated and to match existing frames and covers.
 - b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint 15-mil minimum thickness applied to all surfaces, unless otherwise indicated.

2.11 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.12 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

A. Description, General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total lengths indicated.

B. Manufacturers:

1. ABT, Inc.
2. ACO Polymer Products, Inc.
3. Innovative Plastics Products, Inc.
4. Mea-Josam Div.; Josam Company.
5. Strongwell; Lenoir City Div.

C. Sloped-Invert, Polymer-Concrete Systems: Include the following components:

1. Channel Sections: Interlocking-joint, precast, modular units with end caps. Include inside width and depth as indicated with rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
 - a. Frame: Include gray-iron or steel frame for grate.
2. Grates with manufacturer's designation "Heavy Duty," with slots or perforations that fit recesses in channels.
 - a. Material: Gray iron.
3. Covers: Solid gray iron, if indicated.
4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

D. Narrow-Width, Level-Invert, Polymer-Concrete Systems: Include the following components:

1. Channel Sections: Interlocking-joint, precast, modular units with end caps. Include 5-inch inside width and 9-3/4-inch deep, rounded bottom, with level invert and with NPS 4 outlets in number and locations indicated.
2. Grates with slots or perforations that fit recesses in channels.
 - a. Material: Gray iron.
3. Covers: Solid gray iron, if indicated.

4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- E. Wide-Width, Level-Invert, Polymer-Concrete Systems: Include the following components:
1. Channel Sections: Interlocking-joint, precast, modular units with end caps. Include 8-inch inside width and 13-3/4-inch-deep, rounded bottom, with level invert and with outlets in number, sizes, and locations indicated.
 2. Grates with slots or other openings that fit recesses in channels.
 - a. Material: Gray iron.
 3. Covers: Solid gray iron, if indicated.
 4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- F. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
- G. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.13 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 2. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
 3. Top Section: Flat-slab-top type with hole for frame and grate is indicated.
 4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 5. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
 6. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match frame and grate.
 7. Steps: Not Used.
 8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section. Size sections and box or manhole to fit pipes without necessary.
 9. Catch basins shall be provided by the contractor in an appropriate size to accommodate the pipe size, material, flow lines and arrangement as shown on the plans.
- B. Cast-in-Place Concrete, Catch Basins: Construct of reinforced concrete; designed according to ASTM C 890 for structural loading; of depth, shape, dimensions, and appurtenances indicated.
1. Bottom, Walls, and Top: Reinforced concrete.
 2. Channels and Benches: Concrete.
 3. Steps: Not used.
- C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for H-20, structural loading. Include flat grate with small square or short-slotted drainage openings. All grates shall

be bicycle proof. Grates installed in pedestrian areas shall be heel proof as determined by the manufacturer.

1. Size: 24 by 24 inches minimum, unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2.14 STORMWATER INLETS

- A. Gutter Inlets: Horizontal gutter opening, of materials and dimensions indicated. Include heavy-duty frames and grates. All grates to be bicycle safe.
- B. Combination Inlets: Vertical curb and horizontal gutter openings, of materials and dimensions indicated. Include heavy-duty frames and grates.

2.15 PIPE OUTLETS

- A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
- B. Riprap Basins: Broken, irregular size and shape, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
- C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size, graded stone.
- D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

2.16 DRY WELLS

- A. Description: ASTM C 913, precast, reinforced, perforated concrete manholes with ring and cover, frame and grate, or lid as indicated and include the following:
 1. Floor: Cast-in-place concrete support ring.
 2. Cover: Liftoff-type concrete cover with cast-in lift rings.
 3. Wall Thickness: 4 inches minimum with 1-inch diameter or 1-by-3-inch maximum slotted perforations arranged in rows parallel to axis of ring.
 - a. Total Free Area of Perforations: Approximately 15 percent of ring interior surface.
 - b. Ring Construction: Designed to be self-aligning.
 4. Filtering Material: ASTM D 448, Size No. 24, 3/4- to 2-1/2-inch washed, crushed stone or gravel. The % of material passing the # 200 sieve shall not exceed 5%.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

- A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
 - 1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
 - a. Flexible or rigid couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
 - 2. Use pressure-type pipe couplings for force-main joints.
- B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- C. Gravity-Flow, Nonpressure Sewer Piping: Use any of the following pipe materials for each size range:
 - 1. PVC water-service pipe; PVC Schedule 40, water-service-pipe fittings; and solvent-cemented joints.
 - 2. PVC sewer pipe and fittings; gaskets; and gasketed joints.
 - 3. Class [1] [2] [3], nonreinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
 - 4. Ductile-iron culvert pipe, ductile-iron standard or compact fittings, gaskets, and gasketed joints.
 - 5. Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
 - 6. Corrugated steel pipe and fittings, standard and special-joint bands, and banded joints.
 - 7. Corrugated aluminum pipe and fittings, standard and special-joint bands, and banded joints.
 - 8. Corrugated PE pipe and fittings, silttight couplings, and coupled joints.

3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.
- F. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at slope indicated.
 - 2. Install piping with restrained joints at tee fittings and at changes in direction for pressure pipe. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - 3. Install piping with cover indicated.
 - 4. Notify engineer of clearance problems that would result in changes to grade and alignment.
 - 5. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
 - 6. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 7. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 8. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
 - 9. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
- G. Install force-main pressure piping according to the following:
 - 1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - 2. Install piping with line and grade as indicated or below frost line if not indicated.
 - 3. Install PVC pressure piping according to AWWA M23 or ASTM D 2774 and ASTM F 1668.
 - 4. Install PVC water-service piping according to ASTM D 2774 and ASTM F 1668.

3.4 PIPE JOINT CONSTRUCTION

- A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
- B. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cement joints.

2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
3. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
4. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
5. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
6. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.

C. Join dissimilar pipe materials with pressure-type couplings.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use same pipe type as sewer line that the cleanout is connected to. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use extra-heavy-duty, top-loading classification cleanouts in roads areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 12 inches around outside of cover. At contractors option, a square block can be used that is at least 12-inches wider than the cover. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.6 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use heavy-duty, top-loading classification drains in vehicle-traffic service areas, earth or unpaved foot-traffic areas and paved foot-traffic areas.
2. Use extra-heavy-duty, top-loading classification drains in roads areas.

B. Embed drains in 4-inch minimum depth of concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in 4-inch minimum concrete around bottom and sides.

3.7 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

- B. Install precast concrete manhole sections according to ASTM C 891.
- C. Construct cast-in-place manholes as indicated.
- D. Install PE sheeting on earth where cast-in-place-concrete manholes are to be built.
- E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

3.8 CATCH BASIN INSTALLATION

- A. Construct catch basins in an appropriate size to accommodate the pipe size, material, flow lines and arrangement as shown on the plans.
- B. Set frames and grates to elevations indicated.
- C. Align boxes so that frame and grates are square to adjacent sidewalks, curbs or roadways.

3.9 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.
- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.
- F. Place cast-in-place concrete according to ACI 318/318R.

3.10 DRAINAGE SYSTEM INSTALLATION

- A. Assemble and install components according to manufacturer's written instructions.
- B. Install with top surfaces of components, except piping, flush with finished surface.
- C. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.
- D. Embed channel sections and drainage specialties in 4-inch minimum concrete around bottom and sides.
- E. Fasten grates to channel sections if indicated.
- F. Assemble channel sections with flanged or interlocking joints.
- G. Embed channel sections in 4-inch minimum concrete around bottom and sides.

3.11 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."
- B. Connect force-main pressure piping to building's storm drainage force mains specified in Division 22 Section "Facility Storm Drainage Piping." Terminate piping where indicated.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- C. Connect to sediment interceptors specified in Division 22 Section "Sanitary Waste Interceptors."

3.12 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - 1. Close open ends of piping with at least 8-inch-thick, brick masonry bulkheads.
 - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
 - 1. Remove manhole or structure and close open ends of remaining piping.
 - 2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Division 31 Section "Earth Moving."

3.13 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use warning tape or detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.14 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - a. Reports shall include a video log of storm drain showing all lineal footage of the system in DVD format. Log shall be submitted to the owner once a month. A final log shall be submitted with the as built drawing for the use of the owner and Architect.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping according to ASTM F 1417.
 - c. Option: Test concrete piping according to ASTM C 924.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.15 CLEANING

- A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION 334100

APPENDIX



Utah State Tax Commission
Exemption Certificate for Governments & Schools
 (Sales, Use, Tourism and Motor Vehicle Rental Tax)

TC-721G
Rev. 3/16

Name of institution claiming exemption (purchaser)		Telephone Number	
Street Address	City	State	ZIP Code
Authorized Signature	Name (please print)	Title	
Name of Seller or Supplier:			Date

The person signing this certificate **MUST** check the applicable box showing the basis for which the exemption is being claimed.

Email questions to taxmaster@utah.gov. You may also write or visit the Tax Commission at 210 N 1950 W, Salt Lake City, UT 84134, or call 801-297-2200 or toll free 1-800-662-4335.

DO NOT SEND THIS CERTIFICATE TO THE TAX COMMISSION
 Keep it with your records in case of an audit.

UNITED STATES GOVERNMENT OR NATIVE AMERICAN TRIBE
 I certify the tangible personal property or services purchased are to be paid directly with funds from the entity noted on this form and will be used in the exercise of essential governmental or tribal functions.
NOTE: Includes sales of tangible personal property to federally chartered credit unions. "Directly" does not include per diem, entity advances, or government reimbursements for employee credit card purchases.

CONSTRUCTION MATERIALS PURCHASED FOR SCHOOLS OR PUBLIC TRANSIT DISTRICTS
 I certify the construction materials purchased are on behalf of a public elementary or secondary school, or public transit district. I further certify the purchased construction materials will be installed or converted into real property owned by the school or public transit district.
 Name of school or public transit district: _____
 Name of project: _____

FOREIGN DIPLOMAT
 I certify the purchases are authorized by a diplomatic tax exemption card issued by the United States.
 Foreign diplomat number: _____

UTAH LOCAL GOVERNMENTS AND PUBLIC ELEMENTARY AND SECONDARY SCHOOLS
Sales Tax License No. _____
 I certify the tangible personal property or services purchased are to be paid directly with funds from the entity noted on this form and will be used in the exercise of that entity's essential functions. For construction materials, if the purchaser is a Utah local government, these construction materials will be installed or converted into real property by employees of this government entity.
CAUTION: This exemption does not apply to government or educational entities of other states and is not valid for lodging-related purchases.

UTAH STATE GOVERNMENT
Sales Tax License No. _____
 I certify the tangible personal property or services purchased are to be paid directly with funds from the entity noted on this form and will be used in the exercise of its essential functions. For construction materials, they will be installed or converted into real property by employees of this government entity.
CAUTION: This exemption does not apply to other states and is not valid for lodging-related purchases.

HEBER VALLEY HISTORIC RAILROAD
 I certify these purchases and sales are by the Heber Valley Historic Railroad Authority or its operators and are related to the operation and maintenance of the Heber Valley Historic Railroad.

To be valid this certificate must be filled in completely, including a check mark in the proper box.

A sales tax license number is required only where indicated.

Please sign, date and, if applicable, include your license or exemption number.

NOTE TO SELLER: Keep this certificate on file since it must be available for audit review.

NOTE TO PURCHASER: Keep a copy of this certificate for your records. You must notify the seller of cancellation, modification, or limitation of the exemption you have claimed.

If you need an accommodation under the Americans with Disabilities Act, email taxada@utah.gov, or call 801-297-3811 or TDD 801-297-2020. Please allow three working days for a response.



MHTN
ARCHITECTS

License and Indemnification Agreement

Project:

MHTN Project No.:

In response to the Receiver's request to obtain Drawings, Specifications, electronic data, and/or other Instruments of Service (the "Information") produced by MHTN Architects, Inc. ("MHTN") for the above referenced project, MHTN and the Receiver agree to the following:

Receiver's authorized representative to initial Receiver's assent to each term in the space provided.

- _____ 1. MHTN grants to the Receiver a non-exclusive license to the Information for production of the Receiver's portion of the work for this project only. The Receiver shall not transfer or assign this license. MHTN retains its copyrights, the right to retain electronic data or other reproducible copies of the Information, and the right to use information, ideas, and/or concepts contained in the Information in the normal course of the its professional activities.
- _____ 2. The Information is for information purposes only. Under no circumstances shall the conveyance of the Information be deemed a sale by MHTN. MHTN makes no warranties, express or implied, of merchantability or of fitness of the Information for a particular purpose.
- _____ 3. The Receiver shall remove all title blocks and other references to MHTN, MHTN's consultants, and the project owner from the electronic data contained in the Information upon receipt.
- _____ 4. The Receiver shall remove all notes, text, and detail cuts from the electronic data contained in the Information upon receipt.
- _____ 5. Use of the Information shall be at Receiver's sole risk and without liability to MHTN or its consultants. The Receiver shall make no claim against MHTN or its consultants. The Receiver shall defend, indemnify, and hold harmless MHTN, MHTN's consultants, and agents and employees of any of them from and against all claims, damages, losses, and expenses, including but not limited to attorney fees and costs, arising out of the Receiver's use of the Information.

Receiver Company Name:

Officer & Title (printed): _____

Officer & Title (signed): _____

Date: _____

MHTN Architects, Inc.

Representative & Title:

Representative & Title (signed): _____

Date: _____



Project: _____ Substitution Request Number: _____
 _____ From: _____
 To: _____ Date: _____
 _____ A/E Project Number: _____
 Re: _____ Contract For: _____

Specification Title: _____ Description: _____
 Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
 Manufacturer: _____ Address: _____ Phone: _____
 Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule..
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____
 Signed by: _____
 Firm: _____
 Address: _____

 Telephone: _____

A/E's REVIEW AND ACTION

- Substitution approved - Make submittals in accordance with Specification Section 013300.
- Substitution approved as noted - Make submittals in accordance with Specification Section 013300.
- Substitution rejected - Use specified materials.
- Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

Supporting Data Attached: Drawings Product Data Samples Tests Reports _____



SUBSTITUTION REQUEST (After the Bidding Phase)

Project: _____ Substitution Request Number: _____

 To: _____ From: _____
 _____ Date: _____
 Re: _____ A/E Project Number: _____
 _____ Contract For: _____

Specification Title: _____ Description: _____
 Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
 Manufacturer: _____ Address: _____ Phone: _____
 Trade Name: _____ Model No.: _____
 Installer: _____ Address: _____ Phone: _____
 History: New product 2-5 years old 5-10 yrs old More than 10 years old
 Differences between proposed substitution and specified product: _____

Point-by-point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: _____

Similar Installation:
 Project: _____ Architect: _____
 Address: _____ Owner: _____
 _____ Date Installed: _____

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

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

Proposed substitution changes Contract Time: No Yes [Add] [Deduct] _____ days.

Supporting Data Attached: Drawings Product Data Samples Tests Reports _____

SUBSTITUTION REQUEST (Continued)

The Undersigned certifies:

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

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: _____

A/E's REVIEW AND ACTION

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

Signed by:

Date:

Additional Comments: Contractor Subcontractor Supplier Manufacturer A/E _____

