Specifications

RUNNING TRACK AND SUPPORT BUILDING

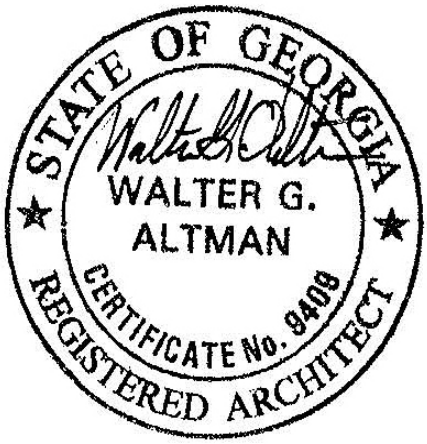
FOR

WORTH HIGH SCHOOL

407 WEST BRYANT DRIVE, SYLVESTER, GA 31791

WORTH COUNTY SCHOOL SYSTEM

MAY 8, 2020



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RUNNING TRACK AND SUPPORT BUILDING
For
WORTH HIGH SCHOOL
407 WEST BRYANT DRIVE, SYLVESTER, GA 31791
WORTH COUNTY SCHOOL SYSTEM

May 8, 2020

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SECTION 000101

PROJECT TITLE PAGE

1.01 PROJECT MANUAL

A. Running Track and Support Building for Worth High School.

B. Worth County School District.

C. 103 Eldridge Street, Sylvester, GA 31791.

D. Architect Project No. 20001.

E. Altman + Barrett Architects, P.C.

F. 117 West Main Street.

G. Hahira, GA 31632.

H. Phone: 229-585-9018.

I. Website: www.altmanbarrettarchitects.com.

J. Issued: May 11, 2020.

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END OF DOCUMENT 000101

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SECTION 000115

LIST OF DRAWING SHEETS

1.01 LIST OF DRAWINGS

A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Running Track and Support Building for Worth High School, dated May 8, 2020, as modified by subsequent Addenda and Contract modifications.

END OF DOCUMENT 000115

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SECTION 001116

INVITATION TO BID

1.01 PROJECT INFORMATION

A. Notice to Bidders: **Qualified** bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.

B. Project Identification: Running Track and Support Building for Worth High School.

1. Project Location: Worth High School – 407 West Bryant Drive Sylvester, GA 31791

C. Owner: Worth County School District – 103 Eldridge Street, Sylvester, GA 31791.

1. Owner's Representative: Mr. Bill Settle.

D. Architect: Altman + Barrett Architects, P.O. Box 665 Hahira, GA 31632.

E. Project Description: Project consists of Construction of a new 8 lane 400m running track with a support building to include restrooms, concession, and storage. In addition to the running track and support building, project will include sports lighting, aluminum bleachers, concrete sidewalks, fencing, and site utilities.

F. Construction Contract: Bids will be received for the following Work:

1. General Contract (all trades).

1.02 BID SUBMITTAL AND OPENING

A. Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:

1. Bid Date: June 11, 2020.
2. Bid Time: **2:00 p.m.**, local time.
3. Location: Worth County School District (Board Room) 103 Eldridge Street, Sylvester, GA 31791.

B. Bids will be thereafter publicly opened and read aloud.

1.03 BID SECURITY

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

1.04 PREBID CONFERENCE

A. A mandatory pre-bid conference for all bidders will be held at Worth County High School on May 28, 2020 at **10:00 a.m.**, local time. Prospective bidders are **required** to attend.

1.05 DOCUMENTS

A. Printed Procurement and Contracting Documents: Obtain after May 10, 2020, by contacting Print Life Printing and Supplies, Inc., 1006 Williams St. Valdosta, GA 31601 or by calling (229)244-5598. Only complete sets of documents will be issued.

1. Payment: $200.00 made payable to Print Life Printing and Supplies.
2. Shipping: Additional shipping charges may apply.

B. Viewing Procurement and Contracting Documents: Examine after May 10, 2020, at the locations below:

1. www.altmanbarrettarchitects.com

1.06 TIME OF COMPLETION

A. Bidders shall begin the Work on receipt of the Notice to Proceed (estimated June 19, 2020) and shall complete the Work prior to December 31, 2020.

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1.07 BIDDER'S QUALIFICATIONS

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

END OF DOCUMENT 001116

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SECTION 002113

INSTRUCTIONS TO BIDDERS

PART 1 - INSTRUCTIONS TO BIDDERS

1.01 AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.

A. A copy of AIA Document A701, "Instructions to Bidders," is bound in this Project Manual.

END OF DOCUMENT 002113

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AIA® Document A701™ – 2018

Instructions to Bidders

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

20001 Worth HS Track & Field Facility
Sylvester, GA
A New Track and Field Facility for Worth High School. Includes a Restroom, Concession, and Storage Building.

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

Worth County Schools
103 Eldridge Street
Sylvester, GA 31791
Telephone Number: 229-776-8600

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

Altman + Barrett Architects
P.O. Box 665 / 117 W. Main Street
Hahira, GA 31632
Telephone Number: 2295859018

TABLE OF ARTICLES

1 DEFINITIONS

2 BIDDER'S REPRESENTATIONS

3 BIDDING DOCUMENTS

4 BIDDING PROCEDURES

5 CONSIDERATION OF BIDS

6 POST-BID INFORMATION

7 PERFORMANCE BOND AND PAYMENT BOND

8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

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

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

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

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

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ARTICLE 1 DEFINITIONS

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

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

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

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

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

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

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

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

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

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

- **.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 from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.
(Paragraphs deleted)

§ 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.

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§ 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.

email: mail@altmanbarrettarchitects.com

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

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

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

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

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

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

§ 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.
(Paragraphs deleted)
§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than three 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.

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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:

AIA Document A310-210
5%

§ 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, beginning60days 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:
(Paragraph deleted)
Paper copy at or before date and time of bid opening.

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§ 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:
(Paragraph deleted)
The bid security will be released to Bidder

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.

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§ 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.

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§ 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.)

(Paragraphs deleted)

.5 Drawings

Number	**Title**	**Date**

.6 Specifications

Section	**Title**	**Date**	**Pages**

.7 Addenda:

Number	**Date**	**Pages**

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

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

[ ] The Sustainability Plan:

Title	**Date**	**Pages**

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[X] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
Included within 002113			

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

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DRAFT

AIA® Document A101™ – 2017

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

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

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

«Worth County Schools»«»
«103 Eldridge Street
Sylvester, GA 31791»
«Telephone Number: 229-776-8600»
«»

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

« »« »
« »
« »
« »

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

«20001 Worth HS Track & Field Facility»
«Sylvester, GA»
«A New Track and Field Facility for Worth High School. Includes a Restroom, Concession, and Storage Building.»

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

«Altman + Barrett Architects»«»
«P.O. Box 665 / 117 W. Main Street
Hahira, GA 31632»
«Telephone Number: 2295859018»
«»

The Owner and Contractor agree as follows.

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

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

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

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TABLE OF ARTICLES

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EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

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

ARTICLE 2 THE WORK OF THIS CONTRACT

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

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

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

[« »] The date of this Agreement.

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

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

« »

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

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

§ 3.3 Substantial Completion

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

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

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[« »] By the following date: « »

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

Portion of Work	Substantial Completion Date

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

ARTICLE 4 CONTRACT SUM

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

§ 4.2 Alternates

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

Item	Price

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

Item	Price	Conditions for Acceptance

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

Item	Price

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

Item	Units and Limitations	Price per Unit ($0.00)

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

« »

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

« »

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ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

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

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

« »

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

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

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

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

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

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

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

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

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

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

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

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

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

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

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

« »

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

« »

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

« »

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

« »

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

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

§ 5.2 Final Payment

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

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

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

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

« »

§ 5.3 Interest

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

« » % « »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

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

« »
« »
« »
« »

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§ 6.2 Binding Dispute Resolution

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

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

[« »] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

« »

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

ARTICLE 7 TERMINATION OR SUSPENSION

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

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

« »

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

ARTICLE 8 MISCELLANEOUS PROVISIONS

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

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

«William Settle»
«103 Eldridge Street
Sylvester, GA 31791»
«»
«»
«»
«»

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

« »
« »
« »
« »
« »
« »

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

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§ 8.5 Insurance and Bonds

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

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

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

« »

§ 8.7 Other provisions:

« »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

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

« »

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

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

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

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

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« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

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

« »

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

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
«William Settle»«, Superintendent»	« »« »
(Printed name and title)	*(Printed name and title)*

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DRAFT

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 «Fifteenth» day of «January» in the year «Two Thousand Twenty»
(In words, indicate day, month and year.)

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

«20001 Worth HS Track & Field Facility»
«Sylvester, GA»

THE OWNER:
(Name, legal status and address)

«Worth County Schools»«»
«103 Eldridge Street
Sylvester, GA 31791»

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.

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.

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.

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§ A.2.3 Required Property Insurance

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

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

Causes of Loss	Sub-Limit

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

Coverage	Sub-Limit

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

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

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

§ A.2.3.3 Insurance for Existing Structures

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

§ A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.

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(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

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

« »

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

« »

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

« »

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

« »

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

« »

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

« »

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

« »

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

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

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

« »

[« »] **§ A.2.5.2 Other Insurance**
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

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

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

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

§ A.3.2 Contractor's Required Insurance Coverage

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

« »

§ A.3.2.2 Commercial General Liability

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

.1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
.2 personal injury and advertising injury;
.3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
.4 bodily injury or property damage arising out of completed operations; and

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.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 residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
.8 Claims related to roofing, if the Work involves roofing.
.9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
.10 Claims related to earth subsidence or movement, where the Work involves such hazards.
.11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

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

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

§ A.3.2.5 Workers' Compensation at statutory limits.

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

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

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

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

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

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

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

§ A.3.3 Contractor's Other Insurance Coverage

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

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

« »

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[« »] **§ A.3.3.2.1** Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:

(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

« »

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

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

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

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

[« »] **§ A.3.3.2.6 Other Insurance**

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

Coverage	Limits

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§ 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	
Performance Bond	

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

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

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

« »

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AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

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

20001 Worth HS Track & Field Facility
Sylvester, GA

THE OWNER:
(Name, legal status and address)

Worth County Schools
103 Eldridge Street
Sylvester, GA 31791

THE ARCHITECT:
(Name, legal status and address)

Altman + Barrett Architects
P.O. Box 665 / 117 W. Main Street
Hahira, GA 31632

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

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

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

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14 TERMINATION OR SUSPENSION OF THE CONTRACT

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

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

§ 1.8 Building Information Models Use and Reliance

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

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

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

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

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

§ 2.3 Information and Services Required of the Owner

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

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such 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.

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

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

§ 3.5 Warranty

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

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

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

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

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§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

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

§ 3.9 Superintendent

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

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

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

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

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

§ 3.11 Documents and Samples at the Site

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

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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

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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.

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§ 3.18 Indemnification

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

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

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

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

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

§ 4.2.4 Communications

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

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

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

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's 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.

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ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

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

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

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

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

§ 5.3 Subcontractual Relations

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

§ 5.4 Contingent Assignment of Subcontracts

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

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

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

§ 6.2 Mutual Responsibility

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

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

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

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

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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:

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

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

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

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

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

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

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

§ 7.4 Minor Changes in the Work

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

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

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

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

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

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

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

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

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

§ 9.4 Certificates for Payment

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

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

§ 9.5 Decisions to Withhold Certification

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

.1 defective Work not remedied;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

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

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

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

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

§ 9.6 Progress Payments

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

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

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

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

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

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

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

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

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§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

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

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

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

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

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

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

- **.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

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

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

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

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

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

§ 10.4 Emergencies

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

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

§ 11.2 Owner's Insurance

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

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

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

§ 11.3 Waivers of Subrogation

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

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

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

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

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK
§ 12.1 Uncovering of Work
§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

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

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

§ 12.2.2.2 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.

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§ 13.4 Tests and Inspections

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

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

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

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

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a 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.

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

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.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;

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.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

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

§ 15.1.3 Notice of Claims

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

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost

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

§ 15.1.6 Claims for Additional Time

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

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

§ 15.1.7 Waiver of Claims for Consequential Damages

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

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

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

§ 15.2 Initial Decision

§ 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.

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

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

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

§ 15.3 Mediation

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

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

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

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

§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

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User Notes: (1934522744)

SUPPLEMENTARY CONDITIONS

The following supplements modify the "General Conditions of the Contract for Construction," AIA Documents A201–2017. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

ARTICLE 1 - GENERAL PROVISIONS

A. Add the following sentence to the end of Subparagraph 1.1.1:
The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

B. Add Clause 1.2.1.1 to Subparagraph 1.2.1:
1.2.1.1 In the event of conflicts or discrepancies about the Contract Documents, interpretations will be based on the following priorities:

1. The Agreement.
2. Addenda, with those of later date having precedence over those of earlier date.
3. The Supplementary Conditions.
4. The General Conditions of the Contract for Construction.
5. Division 1 of the Specifications
6. Drawings and Divisions 2-16 of the Specifications.

In the case of conflicts or discrepancies between Drawings and Divisions 2-16 of the Specifications or within either Document not clarified by Addendum, the Architect will determine which takes precedence in accordance with Subparagraph 4.2.11.

C. Add the following Subparagraph 1.6.2 to Paragraph 1.6:
1.6.2 Contractor's Use of Instruments of Service in Electronic Form.

1.6.2.1 The Architect may, with the concurrence of the Owner, furnish to the Contractor versions of Instruments of Service in electronic form. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

1.6.2.2 The Contractor shall not transfer or reuse Instruments of Service in electronic or machine readable form without the prior written consent of the Architect.

ARTICLE 3 - CONTRACTOR

A. Add the following Subparagraph 3.2.4 to Paragraph 3.2:
3.2.4. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for the Architect to evaluate and respond to the Contractor's requests for information, where such information was 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.

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

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

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.4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

C. Add the following Subparagraph 3.4.4 to Paragraph 3.4:
3.4.4 The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect to evaluate the Contractor's proposed substitutions and to make agreed upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of such substitutions.

ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

A. Add Clause 4.2.2.1 to Subparagraph 4.2.1:
4.2.2.1 The Contractor shall reimburse the Owner for compensation paid to the Architect for additional site visits made necessary by the fault, neglect or request of the Contractor.

B. Add the following Clauses 4.3.7.3 and 4.3.7.4 to Subparagraph 4.3.7:
4.3.7.3 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.

4.3.7.4 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.

ARTICLE 7 - CHANGES IN THE WORK

A. Add the following Subparagraph 7.1.4 to Paragraph 7.1:
7.1.4 The combined overhead and profit included in the total cost to the Owner of a change in the Work shall be based on the following schedule:

.1 For the Contractor, for Work performed by the Contractor's own forces, 10 percent of the cost.

.2 For the Contractor, for Work performed by the Contractor's Subcontractors, 5 percent of the amount due the Subcontractors.

.3 For each Subcontractor involved, for Work performed by that Subcontractor's own forces, 10 percent of the cost.

.4 For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, 5 percent of the amount due the Sub-subcontractor.

.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.

.6 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their property 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 $1000.00 be approved without such itemization.

ARTICLE 9 - PAYMENTS AND COMPLETION

A. Option B:
Add the following Clause 9.3.1.3 to Subparagraph 9.3.1:
9.3.1.3 Until final payment, the Owner shall pay 90 percent of the amount due the Contractor on account of progress payments. 10% retainage shall be withheld until job is 100% complete. For each Work category shown to be 50 percent or more complete in the Application for Payment, the Architect will, without reduction of previous retainage, certify any remaining progress payments for each Work category to be paid in full.

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B. Add the following Clause 9.8.3.1 to Subparagraph 9.8.3:
9.8.3.1 Except with the consent of the Owner, 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 shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections.

C. Add the following Clause 9.10.1.1 to Subparagraph 9.10.1:
9.10.1.1 Except with the consent of the Owner, 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 shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections.

D. In Subparagraph 9.10.2 omit, "(5) if required by the Owner, . . . designated by the Owner" and substitute the following: "(5) Statutory Affidavit executed by the Contractor and all Subcontractors in the form following this section."

ARTICLE 11 - INSURANCE AND BONDS

A. Add the following Clauses 11.1.2.1 through 11.1.2.4 to Subparagraph 11.1.2:
11.1.2.1 The limits for Worker's Compensation and Employer's Liability insurance shall meet statutory limits mandated by State and Federal Laws. If (1) limits in excess of those required by statute are to be provided or (2) the employer is not statutorily bound to obtain such insurance coverage or (3) additional coverages are required, additional coverages and limits for such insurance shall be as follows:

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

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

.1 The policy shall be endorsed to have the General Aggregate apply to this Project only.
.2 The Contractual Liability insurance shall include coverage sufficient to meet the obligations in AIA Documents A201-2007 under Paragraph 3.18.
.3 Products and Completed Operations insurance shall be maintained for a minimum period of at least One (1) year(s) after either 90 days following Substantial Completion or final payment, whichever is earlier.

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

$ 1,000,000. Each Accident

11.1.2.4 Umbrella or Excess Liability coverage shall be as follows:

B. **11.3.1** Modify the first sentence of Subparagraph 11.4.1 as follows: Delete "Unless otherwise provided, the Owner" and substitute "The Contractor." Add the following sentences:

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

C. **11.3.1.3** Modify Clause 11.4.1.3 by substituting "Contractor" for Owner."
D. **11.3.4** Delete Subparagraph 11.4.4.

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E. **11.3.6** Modify Subparagraph 11.4.6 by making the following substitutions: (1) in the first sentence, substitute "Contractor" for "Owner" and "Owner" for "Contractor," and (2) substitute "Owner" for "Contractor" at the end of the last sentence.

F. **11.3.7** Modify Subparagraph 11.4.7 by substituting "Contractor" for "Owner" at the end of the first sentence.

G. **11.3.8** Modify Subparagraph 11.4.8 by substituting "Contractor" for "Owner"; except that at the first reference to "Owner" in the first sentence, the word "this" should be substituted for "Owner's."

H. **11.3.9** Modify Subparagraph 11.4.9 by substituting "Contractor" for "Owner" each time the latter word appears except in the last sentence.

I. **11.3.10** Modify Subparagraph 11.4.10 by substituting "Contractor" for "Owner" each time the latter word appears.

J. Delete Subparagraph 11.4.1 and substitute the following:
11.4.1 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.

K. **11.4.1.1** The Contractor shall deliver the required bonds to the Owner not later than three days following the date the Agreement is entered into, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

L. **11.4.1.2** 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.

STATUTORY AFFIDAVIT

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STATE OF _____ COUNTY OF_____

FROM:_____
(Contractor)

TO:_____

RE: Contract entered into this _____ day of _____, 20_____, between the above mentioned parties for the construction of a _____

_____.

KNOW ALL MEN BY THESE PRESENTS:

1. The undersigned hereby certifies that all work required under the above contract has been performed in accordance with the terms thereof, that all material men, subcontractors, mechanics and laborers have been paid and satisfied in full and that there are not outstanding claims of any character arising out of the performance of the Contract which have not been paid and satisfied in full.

2. The undersigned further certifies that to the best of his knowledge and belief there are not unsatisfied claims for damages resulting from injury or death to any employee, subcontractor, or the public at large arising out of the performance of the contract, or any suits or claims for any other damage of any kind, nature, or description which might constitute a lien upon the property of the Owner.

3. The undersigned makes this affidavit as provided by law and for the purpose of receiving final payment in full settlement of all claims arising under or by virtue of the Contract, and acceptance of such payment is acknowledged as a release of the Owner from any and all claims arising under or by virtue of the Contract.

IN WITNESS WHEREOF, the undersigned has signed and sealed this instrument

this _____ day of _____, 20_____.

_____

_____

Personally appeared before the undersigned, _____ and _____ who after being duly sworn, depose(s) and say(s) that the facts stated in the above affidavit are true.

_____
(Notary Public)

This _____ day of _____, 20____.

My Commission expires _____.

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SECTION 002213

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

1.01 INSTRUCTIONS TO BIDDERS

A. Instructions to Bidders for Project consist of the following:

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

1.02 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, GENERAL

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

1.03 ARTICLE 2 - BIDDER'S REPRESENTATIONS

A. Add Section 2.1.3.1:

1. 2.1.3.1 - The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.

B. Add Section 2.1.5:

1. 2.1.5 - The Bidder is a properly licensed Contractor according to the laws and regulations of State of Georgia and Liberty County and meets qualifications indicated in the Procurement and Contracting Documents.

C. Add Section 2.1.6:

1. 2.1.6 - The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

1.04 ARTICLE 3 - BIDDING DOCUMENTS

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

1. Add Section 3.2.2.1:
   a) 3.2.2.1 - Submit Bidder's Requests for Interpretation using form **bound in the Project Manual.**

B. 3.4 - Addenda:

1. Delete Section 3.4.3 and replace with the following:
   a) 3.4.3 - Addenda may be issued at any time prior to the receipt of bids.
2. Add Section 3.4.4.1:
   a) 3.4.4.1 - Owner may elect to waive the requirement for acknowledging receipt of 3.4.4 Addenda as follows:
      1) 3.4.4.1.1 - Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Procurement and Contracting Documents included in an unacknowledged Addendum.
      2) 3.4.4.1.2 - Modifications to the Procurement and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

1.05 ARTICLE 4 - BIDDING PROCEDURES

A. 4.1 - Preparation of Bids:

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

B. 4.3 - Submission of Bids:
1. Add Section 4.3.1.2:
   a) 4.3.1.2 - Include Bidder's Contractor License Number applicable in Project jurisdiction on the face of the sealed bid envelope.

C. 4.4 - Modification or Withdrawal of Bids:
1. Add the following sections to 4.4.2:
   a) 4.4.2.1 - Such modifications to or withdrawal of a bid may only be made by persons authorized to act on behalf of the Bidder. Authorized persons are those so identified in the Bidder's corporate bylaws, specifically empowered by the Bidder's charter or similar legally binding document acceptable to Owner, or by a power of attorney, signed and dated, describing the scope and limitations of the power of attorney. Make such documentation available to Owner at the time of seeking modifications or withdrawal of the Bid.
   b) 4.4.2.2 - Owner will consider modifications to a bid written on the sealed bid envelope by authorized persons when such modifications comply with the following: the modification is indicated by a percent or stated amount to be added to or deducted from the Bid; the amount of the Bid itself is not made known by the modification; a signature of the authorized person, along with the time and date of the modification, accompanies the modification. Completion of an unsealed bid form, awaiting final figures from the Bidder, does not require power of attorney due to the evidenced authorization of the Bidder implied by the circumstance of the completion and delivery of the Bid.

D. 4.6 - Subcontractors, Suppliers, and Manufacturers List Bid Supplement:
1. Add Section 4.6:
   a) 4.6 - Provide list of major subcontractors, suppliers, and manufacturers furnishing or installing products no later than **two** business days following Architect's request. Include those subcontractors, suppliers, and manufacturers providing work totaling **three** percent or more of the Bid amount. Do not change subcontractors, suppliers, and manufacturers from those submitted without approval of Architect.

1.06 ARTICLE 5 - CONSIDERATION OF BIDS

1.07 ARTICLE 6 - POSTBID INFORMATION

A. 6.1 - Contractor's Qualification Statement:
1. Add Section 6.1.1:

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a) 6.1.1 - Submit Contractor's Qualification Statement no later than **two** business days following Architect's request.

B. 6.3 - Submittals:

1. Add Section 6.3.1.4:

a) 6.3.1.4 - Submit information requested in Sections 6.3.1.1, 6.3.1.2, and 6.3.1.3 no later than **two** business days following Architect's request.

1.08 ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

A. 7.1 - Bond Requirements:

1. Add Section 7.1.1.1:

a) 7.1.1.1 - Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.

B. 7.2 - Time of Delivery and Form of Bonds:

1. Delete the first sentence of Section 7.2.1 and insert the following:

a) The Bidder shall deliver the required bonds to Owner no later than **10** days after the date of Notice of Intent to Award and no later than the date of execution of the Contract, whichever occurs first. Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.

2. Delete Section 7.2.3 and insert the following:

a) 7.2.3 - Bonds shall be executed and be in force on the date of the execution of the Contract.

1.09 ARTICLE 9 - EXECUTION OF THE CONTRACT

A. Add Article 9:

1. 9.1.1 - Subsequent to the Notice of Intent to Award, and within **10** days after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner through **Architect**, in such number of counterparts as Owner may require.

2. 9.1.2 - Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds when the Agreement is presented for signature within the period of time allowed.

3. 9.1.3 - Unless otherwise indicated in the Procurement and Contracting Documents or the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement **or the date that the Bidder is obligated to deliver the executed Agreement and required bonds to Owner**.

4. 9.1.4 - In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or re-advertise for bids.

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SECTION 002513

PREBID MEETINGS

PART 1 - PREBID MEETING

1.01 **Architect** will conduct a mandatory pre-bid meeting as indicated below:
- A. Meeting Date: May 28, 2020.
- B. Meeting Time: **10:00 a.m.**, local time.
- C. Location: Worth County High School, 407 West Bryant Drive, Sylvester, GA 31791

1.02 Attendance:
- A. Prime Bidders: Attendance at Prebid meeting is **required**.
- B. Subcontractors: Attendance at Prebid meeting is recommended.

1.03 Bidder Questions: Submit written questions to be addressed at Prebid meeting minimum of **two** business days prior to meeting.

1.04 Agenda: Prebid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:

1. Procurement and Contracting Requirements:
   - a) Advertisement for Bids.
   - b) Instructions to Bidders.
   - c) Bidder Qualifications.
   - d) Bonding.
   - e) Insurance.
   - f) Bid Security.
   - g) Bid Form and Attachments.
   - h) Bid Submittal Requirements.
   - i) Bid Submittal Checklist.
   - j) Notice of Award.
2. Communication during Bidding Period:
   - a) Obtaining documents.
   - b) Access to Project Web site.
   - c) Bidder's Requests for Information.
   - d) Bidder's Substitution Request/Prior Approval Request.
   - e) Addenda.
3. Contracting Requirements:
   - a) Agreement.
   - b) The General Conditions.
   - c) The Supplementary Conditions.
   - d) Other Owner requirements.
4. Construction Documents:
   - a) Scopes of Work.
   - b) Temporary Facilities.
   - c) Use of Site.
   - d) Work Restrictions.
   - e) Alternates, Allowances, and Unit Prices.
   - f) Substitutions following award.
5. Separate Contracts:
   - a) Work by Owner.
   - b) Work of Other Contracts.

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6. Schedule:
    a) Project Schedule.
    b) Contract Time.
    c) Liquidated Damages.
    d) Other Bidder Questions.
7. Site/facility visit or walkthrough.
8. Post-Meeting Addendum.

1.05 Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes to attendees and others known by the issuing office to have received a complete set of Procurement and Contracting Documents. Minutes of meeting are issued as Available Information and do not constitute a modification to the Procurement and Contracting Documents. Modifications to the Procurement and Contracting Documents are issued by written Addendum only.

A. Sign-in Sheet: Minutes will include list of meeting attendees.
B. List of Planholders: Minutes will include list of planholders.

END OF DOCUMENT 002513

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SECTION 002600

PROCUREMENT SUBSTITUTION PROCEDURES

PART 1 - DEFINITIONS

1.01 Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.

1.02 Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 012500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

PART 2 - QUALITY ASSURANCE

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

PART 3 - PROCUREMENT SUBSTITUTIONS

3.01 Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

3.02 Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:
- A. Extensive revisions to the Contract Documents are not required.
- B. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
- C. The request is fully documented and properly submitted.

PART 4 - SUBMITTALS

4.01 Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing by prime contract Bidder only in compliance with the following requirements:
- A. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
- B. Submittal Format: Submit Procurement Substitution Request.
  1. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
  2. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:

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a) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
b) Copies of current, independent third-party test data of salient product or system characteristics.
c) Samples where applicable or when requested by Architect.
d) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
e) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
f) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.
g) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.

3. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.
4. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

4.02 Architect's Action:

A. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

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

END OF DOCUMENT 002600

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SECTION 003119

EXISTING CONDITION INFORMATION

PART 1 - EXISTING CONDITION INFORMATION

1.01 This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

1.02 Existing drawings that include information on existing conditions including previous construction at Project site are available for viewing by emailing a request to tpetitjean@altmanbarrettarchitects.com.

1.03 Survey information that includes information on existing conditions, prepared by Southeastern Surveying Inc., dated March 13, 2020, is available for viewing by sending request to tpetitjean@altmanbarrettarchitects.com.

1.04 Related Requirements:

A. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.

END OF DOCUMENT 003119

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SECTION 004113

BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

1.01 BID INFORMATION

A. Bidder: _____.

B. Project Name: Running Track and Support Building for Worth High School.

C. Project Location: Worth County High School.

D. Owner: Worth County School District.

E. Architect: Altman + Barrett Architects, P.C.

F. Architect Project Number: 20001.

1.02 CERTIFICATIONS AND BASE BID

A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Altman + Barrett Architects and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. _____Dollars

($_____).

2. The above amount may be modified by amounts indicated by the Bidder on the attached Document 004322 "Unit Prices Form" and Document 004323 "Alternates Form."

1.03 BID GUARANTEE

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

1. _____Dollars

($_____).

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

1.04 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect (estimated June 19, 2020), and shall fully complete the Work prior to December 31, 2020.

1.05 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____.

1.06 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto.

1. Bid Form Supplement - Alternates.
2. Bid Form Supplement - Allowances.
3. Bid Form Supplement - Bid Bond Form (AIA Document A310-2010).

1.07 CONTRACTOR'S LICENSE

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

1.08 SUBMISSION OF BID

A. Respectfully submitted this ____ day of _____, <**Insert year**>.

B. Submitted By:_____(Name of bidding firm or corporation).

C. Authorized Signature:_____(Handwritten signature).

D. Signed By:_____(Type or print name).

E. Title:_____(Owner/Partner/President/Vice President).

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F. Witnessed By:_____(Handwritten signature).

G. Attest:_____(Handwritten signature).

H. By:_____(Type or print name).

I. Title:_____(Corporate Secretary or Assistant Secretary).

J. Street Address:_____.

K. City,State,Zip:_____.

L. Phone:_____.

M. License No.:_____.

N. Federal ID No.:_____(Affix Corporate Seal Here).

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SECTION 004313

BID SECURITY FORMS

PART 1 - BID FORM SUPPLEMENT

1.01 A completed bid bond form is required to be attached to the Bid Form.

PART 2 - BID BOND FORM

2.01 AIA Document A310-2010 "Bid Bond" is the recommended form for a bid bond. A bid bond acceptable to Owner, or other bid security as described in the Instructions to Bidders, is required to be attached to the Bid Form as a supplement.

2.02 Copies of AIA standard forms may be obtained from The American Institute of Architects; https://www.aiacontracts.org/; email: docspurchases@aia.org; (800) 942-7732.

END OF DOCUMENT 004313

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SECTION 004321

ALLOWANCE FORM

PART 1 - BID INFORMATION

1.01 Bidder: _____.

1.02 Project Name: Running Track and Support Building for Worth High School.

1.03 Project Location: Worth County High School.

1.04 Owner: Worth County School District.

1.05 Architect: Altman + Barrett Architects, P.C..

1.06 Architect Project Number: 20001.

PART 2 - BID FORM SUPPLEMENT

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

2.02 The undersigned Bidder certifies that Base Bid submission to which this Bid Supplement is attached includes those allowances described in the Contract Documents and scheduled in Section 012100 "Allowances."

PART 3 - SUBMISSION OF BID SUPPLEMENT

3.01 Respectfully submitted this ____ day of _____, 2020.

3.02 Submitted By:_____(Insert name of bidding firm or corporation).

3.03 Authorized Signature:_____(Handwritten signature).

3.04 Signed By:_____(Type or print name).

3.05 Title:_____(Owner/Partner/President/Vice President).

END OF DOCUMENT 004321

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SECTION 004323

ALTERNATES FORM

PART 1 - BID INFORMATION

1.01 Bidder: _____.

1.02 Project Name: Running Track and Support Building for Worth High School.

1.03 Project Location: Worth County High School.

1.04 Owner: Worth County School District.

1.05 Architect: Altman + Barrett Architects, P.C..

1.06 Architect Project Number: 20001.

PART 2 - BID FORM SUPPLEMENT

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

PART 3 - DESCRIPTION

3.01 The undersigned Bidder proposes the amount below be added to or deducted from the Base Bid if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.

3.02 If the alternate does not affect the Contract Sum, the Bidder shall indicate "NO CHANGE."

3.03 If the alternate does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."

3.04 The Bidder shall be responsible for determining from the Contract Documents the affects of each alternate on the Contract Time and the Contract Sum.

3.05 Owner reserves the right to accept or reject any alternate, in any order, and to award or amend the Contract accordingly within [**60**] days of the Notice of Award unless otherwise indicated in the Contract Documents.

3.06 Acceptance or non-acceptance of any alternates by the Owner shall have no affect on the Contract Time unless the "Schedule of Alternates" Article below provides a formatted space for the adjustment of the Contract Time.

PART 4 - SCHEDULE OF ALTERNATES

4.01 Alternate No. 1 – To Provide Owner Preferred Athletic Lighting Manufacturer (Musco Sports Lighting):

A. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.

_____ Dollars ($_____).

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1. ADD____ DEDUCT ____ (insert calendar days) to adjust the Contract Time for this alternate.

4.02 Alternate No. 2 – Delete the aluminum bleacher system in its entirety:
A. ADD____ DEDUCT___ NO CHANGE____ NOT APPLICABLE____.

_____ Dollars ($_____).
1. ADD____ DEDUCT ____ (insert calendar days) to adjust the Contract Time for this alternate.

4.03 Alternate No. 3 – In lieu of jack and bore for water and sewer piping under existing drives, utilize removal and replacement of existing concrete curbing and asphalt at each location shown on Sheet C2000.
A. ADD____ DEDUCT___ NO CHANGE____ NOT APPLICABLE____.

_____ Dollars ($_____).
1. ADD____ DEDUCT ____ (insert calendar days) to adjust the Contract Time for this alternate.

PART 5 - SUBMISSION OF BID SUPPLEMENT

5.01 Respectfully submitted this ____ day of _____, 2020.

5.02 Submitted By:_____(Insert name of bidding firm or corporation).

5.03 Authorized Signature:_____(Handwritten signature).

5.04 Signed By:_____(Type or print name).

5.05 Title:_____(Owner/Partner/President/Vice President).

END OF DOCUMENT 004323

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SECTION 004393

BID SUBMITTAL CHECKLIST

PART 1 - BID INFORMATION

1.01 Bidder: _____.

1.02 Project Name: Running Track and Support Building for Worth High School.

1.03 Project Location: Worth County High School.

1.04 Owner: Worth County School District.

1.05 Architect: Altman + Barrett Architects, P.C..

1.06 Architect Project Number: 20001.

PART 2 - BIDDER'S CHECKLIST

2.01 In an effort to assist the Bidder in properly completing all documentation required, the following checklist is provided for the Bidder's convenience. The Bidder is solely responsible for verifying compliance with bid submittal requirements.

2.02 Attach this completed checklist to the outside of the Submittal envelope.

A. Used the Bid Form provided in the Project Manual.
B. Prepared the Bid Form as required by the Instructions to Bidders.
C. Indicated on the Bid Form the Addenda received.
D. Attached to the Bid Form: Bid Supplement Form - Allowances.
E. Attached to the Bid Form: Bid Supplement Form - Alternates.
F. Attached to the Bid Form: Bid Bond.
G. Bid envelope shows name and address of the Bidder.
H. Bid envelope shows the Bidder's Contractor's License Number.
I. Bid envelope shows name of Project being bid.
J. Bid envelope shows name of Prime Contract being bid, if applicable.
K. Bid envelope shows time and day of Bid Opening.
L. Verified that the Bidder can provide executed Performance Bond and Labor and Material Bond.
M. Verified that the Bidder can provide Certificates of Insurance in the amounts indicated.

END OF DOCUMENT 004393

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SECTION 01 10 00

SUMMARY OF WORK

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section Includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Phased construction.
   4. Work by Owner.
   5. Owner-furnished products.
   6. Access to site.
   7. Coordination with occupants.
   8. Work restrictions.
   9. Miscellaneous provisions.

B. Related Requirements:
   1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.03 PROJECT INFORMATION

A. Project Identification: 20001 Running Track and Support Building for Worth High School.
   1. Project Location: 407 West Bryant Drive, Sylvester, GA 31791

B. Owner: Worth County School District, 103 EldridgeStreet, Sylvester, GA 31791
   1. Owner's Representative: Mr. Bill Settle, Superintendent

C. Architect: Altman + Barrett Architects, P.O. Box 665 Hahira, GA 31632.

D. Architect's Consultants: Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
   1. Pruett Ford & Associates – Mechanical, Plumbing:
      a) Martin Ford, PE, 1201 Broad Street, Suite 3A, Augusta, GA 30901
   2. Electrical Design Consultants, Augusta – Electrical
      a) Ashley Paulk, P.E., 1201 Broad Street, Suite 1A, Augusta, GA 30901
   3. Lindsey & Ritter , Inc. – Structural
      a) John L. Smart, P.E. – 401 E. Jane Street, Valdosta, GA 31601
   4. M.E. Sack Engineering – Civil
      a) Marcus Sack, P.E., 309 North Main Street, Hinesville, GA 31313

1.04 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
   1. Project consists of Construction of a new 8 lane 400m running track with a support building to include restrooms, concession, and storage. In addition to the running track and support building, project will include sports lighting, aluminum bleachers, concrete sidewalks, fencing, and site utilities.

B. Type of Contract:

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

1.05 ACCESS TO SITE

A. General: Each Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. 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. Limits: Confine construction operations to immediate area of work.
   2. 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.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.06 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
   2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.07 WORK RESTRICTIONS

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

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 7:00 p.m., Monday through Friday, unless otherwise indicated.
   1. Hours for Utility Shutdowns: School Hours

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Architect and Owner not less than ten days in advance of proposed utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Owner not less than two days in advance of proposed disruptive operations.

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E. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01010

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SECTION 012100

ALLOWANCES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Contingency allowances.

C. Related Requirements:

1. Section 014000 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.03 DEFINITIONS

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

1.04 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

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

1.05 ACTION SUBMITTALS

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

1.06 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.

1.07 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.

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B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.08 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 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.

3.03 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Contingency Allowance: Include the sum of $50,000 as a general allowance for unforeseen items and/or added scope items.

1. This allowance includes material cost, receiving, handling, and installation, and Contractor overhead and profit.

END OF SECTION 012100

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SECTION 012300

ALTERNATES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.03 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.04 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A 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

3.01 SCHEDULE OF ALTERNATES

A. Alternate No. 1 – To Provide Owner Preferred Athletic Lighting Manufacturer (Musco Sports Lighting).

B. Alternate No. 2 – Delete the aluminum bleacher system in its entirety.

C. Alternate No. 3 – In lieu of jack and bore for water and sewer piping under existing drives, utilize removal and replacement of existing concrete curbing and asphalt at each location shown on Sheet C2000.

END OF SECTION 012300

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SECTION 012500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 012100 "Allowances" for products selected under an allowance.
2. Section 012300 "Alternates" for products selected under an alternate.
3. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.03 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.

1.04 ACTION SUBMITTALS

A. Substitution Requests: Submit one copy 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.

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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.

1.05 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.

1.06 PROCEDURES

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

1.07 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.

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c) Requested substitution will not adversely affect Contractor's construction schedule.
d) Requested substitution has received necessary approvals of authorities having jurisdiction.
e) Requested substitution is compatible with other portions of the Work.
f) Requested substitution has been coordinated with other portions of the Work.
g) Requested substitution provides specified warranty.
h) If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

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SECTION 012600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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**.

1.04 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: **Architect** will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by **Architect** are not instructions either to stop work in progress or to execute the proposed change.
2. Within **time specified in Proposal Request or 20 days, when not otherwise specified,** after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
   a) Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   b) Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   c) Include costs of labor and supervision directly attributable to the change.
   d) Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   e) Quotation Form: Use **forms acceptable to Architect**.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to **Architect**.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

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

1.05 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

1.06 CHANGE ORDER PROCEDURES

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

1.07 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: **Architect** may issue a Construction Change Directive on **AIA Document G714**. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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SECTION 012900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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.

1.04 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 Architectat earliest possible date, but no later than **seven** days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:
   a) Project name and location.
   b) 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.

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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.
1) Labor.
2) Materials.
3) Equipment.

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 **ten** 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. Allowances: Provide a separate line item in the schedule of values for each allowance.
6. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling **five** percent of the Contract Sum and subcontract amount.
8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.05 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

B. Payment Application Times: Submit Application for Payment to Architect by the 25th day of the month. The period covered by each Application for Payment is one month, ending on the 25th day of the month.
1. Submit draft copy of Application for Payment **three** days prior to due date for review by Architect.

A. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 or AIA Document G732 and AIA Document G703.
1. Other Application for Payment forms proposed by the Contractor shall be acceptable to **Architect** and Owner. Submit forms for approval with initial submittal of schedule of values.

B. 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.

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4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

C. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   3. Provide summary documentation for stored materials indicating the following:
      a) Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
      b) Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
      c) Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

D. Transmittal: Submit **four** 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.

E. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule (preliminary if not final).
   4. Products list (preliminary if not final).
   5. Sustainable design action plans, including preliminary project materials cost data.
   6. Schedule of unit prices.
   7. Submittal schedule (preliminary if not final).
   8. List of Contractor's staff assignments.
   9. List of Contractor's principal consultants.

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10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.

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 meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 3 - PRODUCTS (Not Used)

PART 4 - EXECUTION (Not Used)

END OF SECTION 012900

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SECTION 013100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. RFIs.
   4. Digital project management procedures.
   5. Project meetings.

B. Related Requirements:
   1. Section 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.

1.03 DEFINITIONS

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

1.04 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 **15** 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,]and in prominent location in built facility. Keep list current at all times.

1.05 GENERAL COORDINATION PROCEDURES

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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.

1.06 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) Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      c) Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      d) Show location and size of access doors required for access to concealed dampers, valves, and other controls.
      e) Indicate required installation sequences.
      f) Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide

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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 (32 mm) 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.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

1.07 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.

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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.
    a) Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716 or 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 **fifteen** 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.

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E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number including RFIs that were returned without action or withdrawn.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's response was received.
   8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log. Review response and notify Architect within **seven** days if Contractor disagrees with response.

1.08 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's **BIM model** (if available) or **CAD drawings** will be provided by Architect for Contractor's use during construction if deemed necessary by the Architect.
   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 media determined by Architect only.
   4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.
      a) Subcontractors, and other parties requesting access thru the Contractor to Architect's digital data files shall execute a data licensing agreement in the form of **AIA Document C106** with the Architect.

1.09 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: **Contractor shall 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.

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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.

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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. Project Closeout Conference: **Schedule and conduct** a project closeout conference, at a time convenient to Owner and Architect, but no later than **90** days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
a) Preparation of Record Documents.
b) Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c) Procedures for completing and archiving web-based Project software site data files.
d) Submittal of written warranties.
e) Requirements for preparing operations and maintenance data.
f) Requirements for delivery of material samples, attic stock, and spare parts.
g) Requirements for demonstration and training.
h) Preparation of Contractor's punch list.
i) Procedures for processing Applications for Payment at Substantial Completion and for final payment.
j) Submittal procedures.
k) Owner's partial occupancy requirements.
l) Installation of Owner's furniture, fixtures, and equipment.
m) Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at monthly intervals.

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1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: Representatives of Owner, Architect, and Contractor. 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

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SECTION 013200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

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

1.03 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. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

C. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.04 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. PDF file.

B. Startup construction schedule.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

D. Construction Schedule Updating Reports: Submit with Applications for Payment.

E. Daily Construction Reports: Submit at **weekly** intervals.

F. Material Location Reports: Submit at **monthly** intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

H. Unusual Event Reports: Submit at time of unusual event.

1.05 QUALITY ASSURANCE

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

1.06 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, 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.

1.07 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.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final 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. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   2. 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.
   3. 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.
   4. Punch List and Final Completion: Include not more than 45 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.

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1. Phasing: Arrange list of activities on schedule by phase.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Work Restrictions: Show the effect of the following items on the schedule:
    a) Coordination with existing construction.
    b) Limitations of continued occupancies.
    c) Uninterruptible services.
    d) Partial occupancy before Substantial Completion.
    e) Use-of-premises restrictions.
    f) Provisions for future construction.
    g) Seasonal variations.
    h) Environmental control.

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

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 during 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. 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.

1.08 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within **30** days of date established for **the Notice to Proceed**.
1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

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1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in **10** percent increments within time bar.

1.09 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. Material Location Reports: At **monthly** intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
   1. Material stored prior to previous report and remaining in storage.
   2. Material stored prior to previous report and since removed from storage and installed.
   3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

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

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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SECTION 013233

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.
   3. Preconstruction video recordings.

B. Related Requirements:
   1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
   2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
   3. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.
   4. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.03 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 and video recording**. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within **three** days of taking photographs.
   1. Submit photos **on thumb-drive or by uploading to web-based file sharing software**. Include copy of key plan indicating each photograph's location and direction.
   2. Identification: Provide the following information with each image description:
      a) Name and contact information for photographer.
      b) Date photograph was taken.
      c) Description of location, vantage point, and direction.
      d) Unique sequential identifier keyed to accompanying key plan.

C. Video Recordings: Submit video recordings within **seven** days of recording.
   1. Submit video recordings **on thumb drive or by uploading to web-based file sharing software**. Include copy of key plan indicating each video's location and direction.
   2. Identification: With each submittal, provide the following information:
      a) Name and address of photographer.
      b) Date video recording was recorded.
      c) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

2.01 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

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of not less than **3200 by 2400** pixels. Use flash in low light levels or backlit conditions.

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 high-definition mode. Provide supplemental lighting in low light levels or backlit conditions.

C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

D. File Names: Name media files with **date** and sequential numbering suffix.

2.02 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 **starting construction**, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.

1. Take a minimum of 10**0** photographs to show existing conditions adjacent to property before starting the Work.
2. Take a minimum of 100 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take **20** photographs **weekly coinciding with the cutoff date associated with each Application for Payment**. Select vantage points to show status of construction and progress since last photographs were taken.

2.03 CONSTRUCTION VIDEO RECORDINGS

A. Preconstruction Video Recording: Before starting **demolition,** record video recording of Project site and surrounding properties from different vantage points, as directed by **Architect**.

1. Show existing conditions adjacent to Project site before starting the Work.
2. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of **demolition**.
3. Show protection efforts by Contractor.

PART 3 - PRODUCTS (Not Used)

PART 4 - EXECUTION (Not Used)

END OF SECTION 013233

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SECTION 013300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

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

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

1.03 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."

1.04 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.

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2. 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.
3. 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.

1.05 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. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. 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.

1.06 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
    a) Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

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2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
    a) **Architect reserves** the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on **Architect's** receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow **15** days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. **Architect** will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow **15** days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.07 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.

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4. For equipment, include the following in addition to the above, as applicable:
    a) Wiring diagrams that show factory-installed wiring.
    b) Printed performance curves.
    c) Operational range diagrams.
    d) Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data **unless submittal based on Architect's digital data drawing files is otherwise permitted**.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    a) Identification of products.
    b) Schedules.
    c) Compliance with specified standards.
    d) Notation of coordination requirements.
    e) Notation of dimensions established by field measurement.
    f) Relationship and attachment to adjoining construction clearly indicated.
    g) Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    a) Project name and submittal number.
    b) Generic description of Sample.
    c) Product name and name of manufacturer.
    d) Sample source.
    e) Number and title of applicable Specification Section.
    f) Specification paragraph number and generic name of each item.
3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    a) Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b) Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    a) Number of Samples: Submit **one** full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect 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

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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 set; 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

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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.

1.08 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** 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.

1.09 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

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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. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate actions**, as follows:**
      a) No Exceptions Taken: The submittal is approved and no comments have been noted.
      b) Exceptions Noted: The submittal is approved unless noted otherwise with incorporation of comments noted within the submittal.
      c) Resubmit: The submittal is not approved and must be resubmitted due to the comments noted.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect will **discard** submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

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SECTION 014000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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.

1. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as **freestanding temporary built elements or as part**

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of permanent construction, consisting of multiple products, assemblies, and subassemblies.

2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.04 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.

1.05 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.

1.06 ACTION SUBMITTALS

A. Shop Drawings: For **integrated exterior** mockups.

1. Include plans, sections, and elevations, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.

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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.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Contractor's quality-control personnel.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Reports: Prepare and submit certified written reports and documents as specified.

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

1.08 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.

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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.

1.09 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 E329**; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

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J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups 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.

K. 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.

1.10 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.

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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. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   6. Security and protection for samples and for testing and inspection equipment at Project site.

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

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: **Owner will engage** a qualified **special inspector** to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner **as indicated in the Statement of Special Inspections attached to this Section**, and as follows:

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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

3.01 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.

3.02 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.

3.03 CODE REQUIRED SPECIAL INSPECTION

A. Statement of Special Inspection and included Exhibit 014000 A – Schedule of Special Inspections.

END OF SECTION 014000

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STATEMENT OF SPECIAL INSPECTIONS

PROJECT: Running Track and Support Building for Worth High School

LOCATION: 401 West Bryant Drive, Sylvester, GA

PERMIT APPLICANT: Altman + Barrett Architects

APPLICANT'S ADDRESS: 117 West Main Street, Hahira, GA 31632

ARCHITECT OF RECORD: Walter G. Altman, AIA, NCARB

STRUCTURAL ENGINEER OF RECORD: John L. Smart, PE, SE

MECHANICAL ENGINEER OF RECORD: Martin Ford, PE

ELECTRICAL ENGINEER OF RECORD: James E. Fleming, PE

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: Walter Altman, AIA, NCARB

This Statement of Special Inspections is submitted in accordance with Section 1704.3 of the 2012 International Building Code. It includes a *Schedule of Special Inspection Services* applicable to the above-referenced Project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections. If applicable, it includes *Requirements for Seismic Resistance* and/or *Requirements for Wind Resistance*.

Are *Requirements for Seismic Resistance* included in the *Statement of Special Inspections*? ☐ Yes ☒ No

Are *Requirements for Wind Resistance* included in the *Statement of Special Inspections*? ☐ Yes ☒ No

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Building Official and to the Registered Design Professional in Responsible Charge at a frequency agreed upon by the Design Professional and the Building Official prior to the start of work. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and corrections of any discrepancies noted in the inspections shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge at the conclusion of the project.

Frequency of interim report submittals to the Registered Design Professional in Responsible Charge:

__Weekly _X_Bi-Weekly __Monthly Other; specify:_____

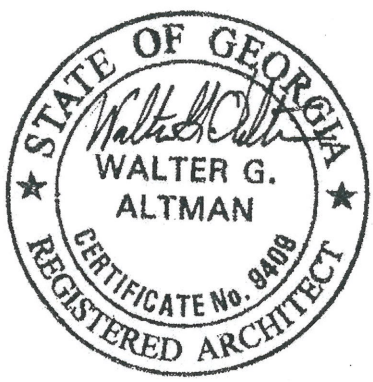
The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Statement of Special Inspections Prepared by:

Walter G. Altman, AIA, NCARB
Type or print name

Walter G. Altman 5/8/2020
Signature Date

Preparer's Seal



Building Official's Acceptance:

Signature Date

Permit Number:

Frequency of interim report submittals to the Building Official:

__Monthly __Bi- Monthly __Upon Completion Other; specify:_____

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT					
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1704.2.5 Inspection of Fabricators					
Verify fabrication/quality control procedures	In-plant review (3)	Y	Periodic		
1705.1.1 Special Cases (work unusual in nature, including but not limited to alternative materials and systems, unusual design applications, materials and systems with special manufacturer's requirements)	Submittal review, shop (3) and/or field inspection	N			
1705.2 Steel Construction		N			
1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 360, chapter N, paragraph 3.2 for compliance with construction documents)	Submittal Review		Each submittal		
2. Material verification of structural steel	Shop (3) and field inspection		Periodic		
3. Embedments (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection		Periodic		
4. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection		Periodic		
5. Structural steel welding:					
a. Inspection tasks Prior to Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-1)	Shop (3) and field inspection		Observe or Perform as noted (4)		
b. Inspection tasks During Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-2)	Shop (3) and field inspection		Observe (4)		
c. Inspection tasks After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-3)	Shop (3) and field inspection		Observe or Perform as noted (4)		
d. Nondestructive testing (NDT) of welded joints: *see Commentary*					
1) Complete penetration groove welds 5/16" or greater in *risk category* III or IV	Shop (3) or field ultrasonic testing - 100%		Periodic		
2) Complete penetration groove welds 5/16" or greater in *risk category* II	Shop (3) or field ultrasonic testing - 10% of welds minimum		Periodic		
3) Thermally cut surfaces of access holes when material t > 2"	Shop (3) or field magnetic Partical or Penetrant testing		Periodic		
4) Welded joints subject to fatigue when required by AISC 360, Appendix 3, Table A-3.1	Shop (3) or field radiographic or Ultrasonic testing		Periodic		
5) Fabricator's NDT reports when fabricator performs NDT	Verify reports		Each submittal (5)		
6. Structural steel bolting:	Shop (3) and field inspection				
a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 360, Table N5.6-1)			Observe or Perform as noted (4)		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT					
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
b.Inspection tasks During Bolting (Observe the QA tasks listed in AISC 360, Table N5.6-2)			Observe (4)		
1) Pre-tensioned and slip-critical joints					
a) Turn-of-nut with matching markings			Periodic		
b) Direct tension indicator			Periodic		
c) Twist-off type tension control bolt			Periodic		
d) Turn-of-nut without matching markings			Continuous		
e) Calibrated wrench			Continuous		
2) Snug-tight joints			Periodic		
c. Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks listed in AISC 360, Table N5.6-3)			Perform (4)		
7. Inspection of steel elements of composite construction prior to concrete placement in accordance with QA tasks listed in AISC 360, Table N6.1	Shop (3) and field inspection and testing		Observe or Perform as noted (4)		
1705.2.2 Steel Construction Other Than Structural Steel		N			
1. Material verification of cold-formed steel deck:					
a. Identification markings	Field inspection		Periodic		
b. Manufacturer's certified test reports	Submittal Review		Each submittal		
2. Connection of cold-formed steel deck to supporting structure:	Shop (3) and field inspection				
a. Welding			Periodic		
b. Other fasteners (in accordance with AISC 360,Section N6)					
1) Verify fasteners are in conformance with approved submittal			Periodic		
2) Verify fastener installation is in conformance with approved submittal and manufacturer's recommendations			Periodic		
3. Reinforcing steel	Shop (3) and field inspection				
a. Verification of weldability of steel other than ASTM A706			Periodic		
b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, boundary elements of special concrete structural walls and shear reinforcement			Continuous		
c. Shear reinforcement			Continuous		
d. Other reinforcing steel			Periodic		
4. Cold-formed steel trusses spanning 60 feet or greater					
a. Verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection		Periodic		
1705.3 Concrete Construction					
1. Inspection of reinforcing steel installation (see 1705.2.2 for welding)	Shop (3) and field inspection	N	Periodic		
2. Inspection of prestressing steel installation	Shop (3) and field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT					
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
3. Inspection of anchors cast in concrete where allowable loads have been increased per section 1908.5 or where strength design is used	Shop (3) and field inspection	Y	Periodic		
4. Inspection of anchors and reinforcing steel post-installed in hardened concrete: Per research reports including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete minimum thickness, anchor embedment and tightening torque	Field inspection	Y	Periodic or as required by the research report issued by an approved source		
5. Verify use of approved design mix	Shop (3) and field inspection	Y	Periodic		
6. Fresh concrete sampling, perform slump and air content tests and determine temperature of concrete	Shop (3) and field inspection	N	Continuous		
7. Inspection of concrete and shotcrete placement for proper application techniques	Shop (3) and field inspection	N	Continuous		
8. Inspection for maintenance of specified curing temperature and techniques	Shop (3) and field inspection	N	Periodic		
9. Inspection of prestressed concrete:	Shop (3) and field inspection	N			
a. Application of prestressing force			Continuous		
b. Grouting of bonded prestressing tendons in the seismic-force-resisting system			Continuous		
10. Erection of precast concrete members		N			
a. Inspect in accordance with construction documents	Field inspection		In accordance with construction documents		
b. Perform inspections of welding and bolting in accordance with Section 1705.2	Field inspection		In accordance with Section 1705.2		
11. Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs	Review field testing and laboratory reports	N	Periodic		
12. Inspection of formwork for shape, lines, location and dimensions	Field inspection	N	Periodic		
13. Concrete strength testing and verification of compliance with construction documents	Field testing and review of laboratory reports	Y	Periodic		
1705.4 Masonry Construction					
(A) Level A, B and C Quality Assurance:					
1. Verify compliance with approved submittals	Field Inspection	Y	Periodic		
(B) Level B Quality Assurance:					
1. Verification of f'm and f'_{AAC} prior to construction	Testing by unit strength method or prism test method	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT					
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
(C) Level C Quality Assurance:		N			
1. Verification of f'm and f'_{AAC} prior to construction and for every 5,000 SF during construction	Testing by unit strength method or prism test method		Periodic		
2. Verification of proportions of materials in premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout, as delivered to the project site	Field inspection		Continuous		
3. Verify placement of masonry units	Field Inspection		Periodic		
(D) Levels B and C Quality Assurance:					
1. Verification of Slump Flow and Visual Stability Index (VSI) of self-consolidating grout as delivered to the project	Field testing	Y	Continuous		
2. Verify compliance with approved submittals	Field inspection	Y	Periodic		
3. Verify proportions of site-mixed mortar, grout and prestressing grout for bonded tendons	Field Inspection	Y	Periodic		
4. Verify grade, type, and size of reinforcement and anchor bolts, and prestressing tendons and anchorages	Field Inspection	Y	Periodic		
5. Verify construction of mortar joints	Field Inspection	Y	Periodic		
6. Verify placement of reinforcement, connectors, and prestressing tendons and anchorages	Field Inspection	Y	Level B - Periodic		
		N	Level C - Continuous		
7. Verify grout space prior to grouting	Field Inspection	Y	Level B - Periodic		
		N	Level C - Continuous		
8. Verify placement of grout and prestressing grout for bonded tendons	Field Inspection	Y	Continuous		
9. Verify size and location of structural masonry elements	Field Inspection	Y	Periodic		
10. Verify type, size, and location of anchors, including details of anchorage of masonry to structural members, frames, or other construction.	Field inspection	Y	Level B - Periodic		
		N	Level C - Continuous		
11. Verify welding of reinforcement (see 1705.2.2)	Field inspection	N	Continuous		
12. Verify preparation, construction, and protestion of masonry during cold weather (temperature below 40^{o}F) or hot weather (temperature above 90^{o}F)	Field inspection	Y	Periodic		
13. Verify application and measurement of prestressing force	Field Inspection	N	Continuous		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT					
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
14. Verify placement of AAC masonry units and construction of thin-bed mortar joints (first 5000 SF of AAC masonry)	Field inspection	N	Continuous		
15. Verify placement of AAC masonry units and construction of thin-bed mortar joints (after the first 5000 SF of AAC masonry)	Field inspection	N	Level B - Periodic		
		N	Level C - Continuous		
16. Verify properties of thin-bed mortar for AAC masonry (first 5000 SF of AAC masonry)	Field inspection	N	Continuous		
17. Verify properties of thin-bed mortar forAAC masonry (after the first 5000 SF of AAC masonry)	Field inspection	N	Level B - Periodic		
		N	Level C - Continuous		
18. Prepare grout and mortar specimens	Field testing	N	Level B - Periodic		
		N	Level C - Continuous		
19. Observe preparation of prisms	Field inspection	N	Level B - Periodic		
		N	Level C - Continuous		
1705.5 Wood Construction		N			
1. Inspection of the fabrication process of wood structural elements and assemblies in accordance with Section 1704.2.5	In-plant review (3)		Periodic		
2. For high-load diaphragms, verify grade and thickness of structural panel sheathing agree with approved building plans	Field inspection		Periodic		
3. For high-load diaphragms, verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines, and that spacing between fasteners in each line and at edge margins agree with approved building plans	Field inspection		Periodic		
4. Metal-plate-connected wood trusses spanning 60 feet or greater: verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection		Periodic		
1705.6 Soils					
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection	Y	Periodic		
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection	Y	Periodic		
3. Perform classification and testing of controlled fill materials.	Field inspection	Y	Periodic		
4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of controlled fill	Field inspection	Y	Continuous		
5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly	Field inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT					
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.7 Driven Deep Foundations		N			
1. Verify element materials, sizes and lengths comply with requirements	Field inspection		Continuous		
2. Determine capacities of test elements and conduct additional load tests, as required	Field inspection		Continuous		
3. Observe driving operations and maintain complete and accurate records for each element	Field inspection		Continuous		
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection		Continuous		
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2		See Section 1705.2		
6. For concrete elements and concrete-filled elements, perform additional inspections per Section 1705.3	See Section 1705.3		See Section 1705.3		
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge	Field inspection		In accordance with construction documents		
8. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing		In accordance with construction documents		
1705.8 Cast-in-Place Deep Foundations		N			
1.Observe drilling operations and maintain complete and accurate records for each element	Field inspection		Continuous		
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	Field inspection		Continuous		
3. For concrete elements, perform additional inspections in accordance with Section 1705.3	See Section 1705.3		See Section 1705.3		
4. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing		In accordance with construction documents		
1705.9 Helical Pile Foundations		N			
1. Verify installation equipment, pile dimensions, tip elevations, final depth, final installation torque and other data as required.	Field inspection		Continuous		
2. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing		In accordance with construction documents		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT					
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.10.1 Structural Wood Special Inspections For Wind Resistance		N			
1. Inspection of field gluing operations of elements of the main windforce-resisting system	Field inspection		Continuous		
2. Inspection of nailing, bolting, anchoring and other fastening of components within the main windforce-resisting system	Shop (3) and field inspection		Periodic		
1705.10.2 Cold-formed Steel Special Inspections For Wind Resistance		N			
1.Inspection during welding operations of elements of the main windforce-resisting system	Shop (3) and field inspection		Periodic		
2.Inspections for screw attachment, bolting, anchoring and other fastening of components within the main windforce-resisting system	Shop (3) and field inspection		Periodic		
1705.10.3 Wind-resisting Components		N			
1. Roof cladding	Shop (3) and field inspection		Periodic		
2. Wall cladding	Shop (3) and field inspection		Periodic		
1705.11.1 Structural Steel Special Inspections for Seismic Resistance		N			
Inspection of structural steel in accordance with AISC 341	Shop (3) and field inspection		In accordance with AISC 341		
1705.11.2 Structural Wood Special Inspections for Seismic Resistance		N			
1. Inspection of field gluing operations of elements of the seismic-force resisting system	Field inspection		Continuous		
2. Inspection of nailing, bolting, anchoring and other fastening of components within the seismic-force-resisting system	Shop (3) and field inspection		Periodic		
1705.11.3 Cold-formed Steel Light-Frame Construction Special Inspections for Seismic Resistance		N			
1. Inspection during welding operations of elements of the seismic-force-resisting system	Shop (3) and field inspection		Periodic		
2. Inspections for screw attachment, bolting, anchoring and other fastening of components within the seismic-force-resisting system	Shop (3) and field inspection		Periodic		
1705.11.4 Designated Seismic Systems Verification		N			
Inspect and verify that that the component label, anchorage or mounting conforms to the certificate of compliance in accordance with Section 1705.12.3	Field inspection		Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT					
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.11.5 Architectural Components Special Inspections for Seismic Resistance		N			
1. Inspection during the erection and fastening of exterior cladding and interior and exterior veneer	Field inspection		Periodic		
2. Inspection during the erection and fastening of interior and exterior nonbearing walls	Field inspection		Periodic		
3. Inspection during anchorage of access floors	Field inspection		Periodic		
1705.11.6 Mechanical and Electrical Components Special Inspections for Seismic Resistance		N			
1. Inspection during the anchorage of electrical equipment for emergency or standby power systems	Field inspection		Periodic		
2. Inspection during the anchorage of other electrical equipment	Field inspection		Periodic		
3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials, and their associated mechanical units	Field inspection		Periodic		
4. Inspection during the installation and anchorage of HVAC ductwork that will contain hazardous materials	Field inspection		Periodic		
5. Inspection during the installation and anchorage of vibration isolation systems	Field inspection		Periodic		
1705.11.7 Storage Racks Special Inspections for Seismic Resistance		N			
Inspection during the anchorage of storage racks 8 feet or greater in height	Field inspection		Periodic		
1705.11.8 Seismic Isolation Systems		N			
Inspection during the fabrication and installation of isolator units and energy dissipation devices used as part of the seismic isolation system	Shop and field inspection		Periodic		
1705.12.1 Concrete Reinforcement Testing and Qualification for Seismic Resistance		N			
1. Review certified mill test reports for each shipment of reinforcement used to resist earthquake-induced flexural and axial forces in reinforced concrete special moment frames, special structural walls, and coupling beams connecting special structural walls	Review certified mill test reports		Each shipment		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT					
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
2. Verify reinforcement weldability of ASTM A615 reinforcement used to resist earthquake-induced flexural and axial forces in reinforced concrete special moment frames, special structural walls, and coupling beams connecting special structural walls	Review test reports		Each shipment		
1705.12.2 Structural Steel Testing and Qualification for Seismic Resistance		N			
Test in accordance with the quality assurance requirements of AISC 341	Shop (3) and field testing		Per AISC 341		
1705.12.3 Seismic Certification of Nonstructural Components		N			
Review certificate of compliance for designated seismic system components.	Certificate of compliance review		Each submittal		
1705.12.4 Seismic Isolation Systems		N			
Test seismic isolation system in accordance with ASCE 7 Section 17.8	Prototype testing		Per ASCE 7		
1705.13 Sprayed Fire-resistant Materials		N			
1. Verify surface condition preparation of structural members	Field inspection		Periodic		
2. Verify application of sprayed fire-resistant materials	Field inspection		Periodic		
3. Verify average thickness of sprayed fire-resistant materials applied to structural members	Field inspection		Periodic		
4. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design	Field inspection and testing		Per IBC Section 1705.13.5		
5. Verify the cohesive/adhesive bond strength of the cured sprayed fire-resistant material	Field inspection and testing		Per IBC Section 1705.13.6		
1705.14 Mastic and Intumescent Fire-Resistant Coatings		N			
Inspect mastic and intumescent fire-resistant coatings applied to structural elements and decks	Field inspection		Periodic		
1705.15 Exterior Insulation and Finish Systems (EIFS)		N			
1. Verify materials, details and installations are per the approved construction documents	Field inspection		Periodic		
2. Inspection of water-resistive barrier over sheathing substrate	Field inspection		Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT					
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	SERVICE	Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.16 Fire-Resistant Penetrations and Joints		N			
1. Inspect penetration firestop	Field testing		Per ASTM E2174		
2. Inspect fire-resistant joint systems	Field testing		Per ASTM E2393		
1705.17 Smoke Control Systems		N			
1. Leakage testing and recording of device locations prior to concealment	Field testing		Periodic		
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and control verification	Field testing		Periodic		

* INSPECTION AGENTS FIRM	ADDRESS	TELEPHONE NO.
1.		
2.		
3.		
4.		

Notes: 1. The inspection and testing agent(s) shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official prior to commencing work. The qualifications of the Special Inspector(s) and/or testing agencies may be subject to the approval of the Building Official and/or the Design Professional.

2. The list of Special Inspectors may be submitted as a separate document, if noted so above.

3. Special Insepctions as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2

4. Observe on a random basis, operations need not be delayed pending these inspections. Perform these tasks for each welded joint, bolted connection, or steel element.

5. NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. Refer to AISC 360, N7.

Are *Requirements for Seismic Resistance* included in the *Statement of Special Inspections*? ~~**Yes**~~ **No**

Are *Requirements for Wind Resistance* included in the *Statement of Special Inspections*? ~~**Yes**~~ **No**

DATE:

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, **Owner's construction forces,** Architect, **occupants of Project,** testing agencies, and authorities having jurisdiction.

B. Sewer Service: **Pay** sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: **Pay** water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: **Pay** electric-power-service use charges for electricity used by all entities for construction operations.

E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.04 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within **15** days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold.

1.05 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.

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B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.06 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts with 1-5/8-inch- (42-mm-) OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide **concrete** bases for supporting posts.

C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors. 85% closed mesh.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E84 and passing NFPA 701 Test Method 2.

2.02 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of contractor and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

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

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.03 EQUIPMENT

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A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
B. HVAC Equipment: **Unless Owner authorizes use of permanent HVAC system**, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 TEMPORARY UTILITY INSTALLATION
A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to **municipal system or private system indicated** as directed by authorities having jurisdiction.
C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
D. 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.
E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
F. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
   1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

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G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
      a) Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
      b) Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
   2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
   3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
   1. Install electric power service **overhead** or **underground** unless otherwise indicated.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.04 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241.
   2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas **within construction limits indicated** on Drawings.
   1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
   1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
   2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to specifications.
   3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
   4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to specifications.

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

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1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
a) Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touch up signs so they are legible at all times.

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

3.05 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Section 011000 Summary.

C. Temporary Erosion and Sedimentation Control: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified.

D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to **erosion- and sedimentation-control Drawings** and **requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent**.
1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

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3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

E. 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.

F. 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.

G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

H. 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.

I. 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.

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

K. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

M. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by **Owner** from fumes and noise.
1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
   a) Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.
3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.

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6. Protect air-handling equipment.
7. Provide walk-off mats at each entrance through temporary partition.

N. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.06 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

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D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
   1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
   3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
      a) Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for **48** hours are considered defective and require replacing.
      b) Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for **48** hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
      c) Remove and replace materials that cannot be completely restored to their manufactured moisture level within **48** hours.

3.07 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
   3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 Closeout Procedures.

END OF SECTION 015000

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SECTION 016000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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.

1.04 ACTION SUBMITTALS

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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.

1.05 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.

1.06 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.

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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.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.07 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

2.01 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.

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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. 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** 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: …"
7. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **will** be considered **unless otherwise indicated**.
    a) Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: …"
8. 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.

B. 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.

C. 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.

2.02 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

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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

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SECTION 017300

EXECUTION

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.

B. Related Requirements:
   1. Section 011000 "Summary" for limits on use of Project site.
   2. Section 013300 "Submittal Procedures" for submitting surveys.
   3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
   4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
   5. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.03 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.

1.04 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at **Project site**.
   1. Prior to **commencing work requiring cutting and patching**, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
      a) Contractor's superintendent.
      b) Trade supervisor responsible for cutting operations.
      c) Trade supervisor(s) responsible for patching of each type of substrate.
      d) Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affecting by cutting and patching operations.
   2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

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1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor and/or professional engineer.

B. Certificates: Submit certificate signed by **land surveyor and/or professional engineer** certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit **two** copies signed by **land surveyor**.

1.06 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.01 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.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning

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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.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to **Owner and Architect** 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."

3.03 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 **land surveyor** 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.

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3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.04 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of **two** permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.05 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 **96 inches (2440 mm)** in occupied spaces and **90 inches (2300 mm)** in unoccupied spaces.

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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.

3.06 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to **prevent** interruption to occupied areas.

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G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. **Concrete and Masonry**: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
      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. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

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

3.07 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.

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2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   a) Use containers intended for holding waste materials of type to be stored.

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 015000 Temporary Facilities and Controls.**

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.08 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.09 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.

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C. Comply with manufacturer's written instructions for temperature and relative humidity.

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SECTION 017700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 ACTION SUBMITTALS

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

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

C. Certified List of Incomplete Items: Final submittal at final completion.

1.04 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.05 MAINTENANCE MATERIAL SUBMITTALS

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

1.06 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.

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2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by **Architect**. Label with manufacturer's name and model number.
5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of **10** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of **10** days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.07 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

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list shall state that each item has been completed or otherwise resolved for acceptance.

3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.08 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) 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 creating and updating list of incomplete items (punch list).

1.09 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 d**ays of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by email to Architect].

PART 2 - PRODUCTS

2.01 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

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are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 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 unless granted otherwise by the Architect.
   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 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.
   p) Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
   q) Leave Project clean and ready for occupancy.

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

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls.

3.02 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.

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SECTION 017823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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.

1.04 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect **and Commissioning Authority** will comment on whether content of operation and maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:
   1. Submit by email to Architect. Enable reviewer comments on draft submittals.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least **15** days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within **15** days of receipt of Architect's comments and prior to commencing demonstration and training.

D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.05 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.

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2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.06 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Construction Manager.
   7. Name and contact information for Architect.
   8. Name and contact information for Commissioning Authority.
   9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
   10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.07 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.

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1.08 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.

1.09 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:

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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.

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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. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

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

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.

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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

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SECTION 017839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

B. Related Requirements:
   1. Section 017300 "Execution" for final property survey.
   2. Section 017700 "Closeout Procedures" for general closeout procedures.
   3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.03 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 record digital data files and **one** set(s) of plots.
         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 two set(s) of prints.
         2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit **annotated PDF electronic files** of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit **annotated PDF electronic files and directories** of each submittal.

E. Reports: Submit written report **monthly** 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.

1.04 RECORD DRAWINGS

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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. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
   2. Format: Annotated PDF electronic file **with comment function enabled**.
   3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
   4. Identification: As follows:

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a) Project name.
b) Date.
c) Designation "PROJECT RECORD DRAWINGS."
d) Name of Architect.
e) Name of Contractor.

1.05 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
   3. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file.

1.06 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 and record Drawings where applicable.

C. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.07 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

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SECTION 017900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.04 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit **two** copies within **seven** days of end of each training module.
   1. Identification: On each copy, provide an applied label with the following information:
      a) Name of Project.
      b) Name and address of videographer.
      c) Name of Architect.
      d) Name of Contractor.
      e) Date of video recording.
   2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
   3. At completion of training, submit complete training manual(s) for Owner's use prepared in same **PDF file** format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.05 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.

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1.06 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.

1.07 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.

1.08 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner**, through Architect,** with at least **seven** days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. 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.

1.09 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified 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.

1. Submit video recordings on thumb drive or by uploading to web-based file share site].
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:

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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) Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
b) 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.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

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SECTION 024113
SITE DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION

This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures and debris from trash dumps shown.

1.02 RELATED WORK

A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished.

B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.

D. Reserved items that are to remain the property of the Owner.

E. Asbestos Removal: See Hazardous Material Sections of General Conditions.

F. Lead Paint: See Hazardous Material Sections of General Conditions.

G. Environmental Protection: See Erosion and Sedimentation Control Specification.

H. Construction Waste Management: See General Requirements Specification.

1.03 PROTECTION

A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations.

C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.

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F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:

1. No wall or part of wall shall be permitted to fall outwardly from structures.

2. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.

3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.

4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Owner; any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.

H. The work shall comply with the requirements of the Erosion and Sediment Control Specification and other sections of this specification.

I. The work shall comply with the requirements of GENERAL REQUIREMENTS.

1.04 UTILITY SERVICES

A. Demolish and remove outside utility service lines shown to be removed.

B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - EXECUTION

2.01 DEMOLITION

A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:

1. In accordance with Building Demolition Specification.

2. As required for installation of new utility service lines.

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3. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.

B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the project site to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Resident Engineer. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

C. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations to a permitted site. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

E. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Resident Engineer. When Utility lines are encountered that are not indicated on the drawings, the Resident Engineer shall be notified prior to further work in that area.

2.02 CLEAN-UP

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Resident Engineer. Clean-up shall include off the offsite disposal of all items and materials not required to remain property of the Owner as well as all debris and rubbish resulting from demolition operations.

END.

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SECTION 024119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.
   3. Salvage of existing items to be reused or recycled.

B. Related Requirements:
   1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
   2. Section 017300 "Execution" for cutting and patching procedures.

1.03 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and **deliver to Owner ready for reuse**.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.04 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.05 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at **Project site**.
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires protection.

1.06 INFORMATIONAL SUBMITTALS

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A. Qualification Data: For refrigerant recovery technician.
B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property and **for dust control**. Indicate proposed locations and construction of barriers.
C. 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 **other tenants** on-site operations are uninterrupted.
    2. Interruption of utility services. Indicate how long utility services will be interrupted.
    3. Coordination for shutoff, capping, and continuation of utility services.
    4. Use of elevator and stairs.
    5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
D. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." 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 indicating that existing warranties are still in effect after completion of selective demolition.

1.07 CLOSEOUT SUBMITTALS
A. Inventory: Submit a list of items that have been removed and salvaged.

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

1.09 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. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
E. Storage or sale of removed items or materials on-site is not permitted.
F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
    1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY
A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

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B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.11 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Survey of Existing Conditions: Record existing conditions by use of **preconstruction photographs or video**.

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.

3.02 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.03 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

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a) Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b) Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
c) Equipment to Be Removed: Disconnect and cap services and remove equipment.
d) Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e) Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f) Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g) Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.04 PROTECTION

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

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.05 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 de-

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signed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least <**Insert number**> hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:
1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.06 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

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D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."[**Do not use methods requiring solvent-based adhesive strippers.**]

E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Division 7 for new roofing requirements.
   1. Remove existing roof membrane, flashings, copings, and roof accessories.
   2. Remove existing roofing system down to substrate.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
   4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.08 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

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SECTION 031000

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

1.2 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.

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.

B. Design, engineer, erect, shore, brace, and maintain concrete forms 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.

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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. Plywood, metal, or other approved panel materials.

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. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. 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.

F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

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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 .

C. Limit concrete surface irregularities as follows:

1. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.

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.

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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.

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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. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

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SECTION 032000

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 ACTION SUBMITTALS

A. 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.

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

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

1.3 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, Grade 60, deformed.

B. Low-Alloy Steel Reinforcing Bars: ASTM A706, deformed.

C. Plain-Steel Welded-Wire Reinforcement: ASTM A1064, plain, fabricated from as-drawn steel wire into flat sheets.

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2.2 REINFORCEMENT ACCESSORIES

A. 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.

B. Steel Tie Wire: ASTM A1064, 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.

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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.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

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. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel-reinforcement placement.

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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, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.
4. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with the following: fly ash materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

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

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Steel-fiber reinforcement content.
10. Synthetic micro-fiber content.

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11. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
12. Intended placement method.
13. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94 and ACI 301.

1.6 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 301unless 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.

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B. Cementitious Materials:

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

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

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260.

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 in steel-reinforced concrete.

1. Water-Reducing Admixture: ASTM C494, Type A.
2. High-Range, Water-Reducing Admixture: ASTM C494, Type F.

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

2.3 FIBER REINFORCEMENT

A. Synthetic Monofilament Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C1116, Type III, 1/2 to 1-1/2 inches long.

B. Synthetic Fibrillated Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C1116, Type III, 1/2 to 1-1/2 inches long.

2.4 CURING MATERIALS

A. Water: Potable or complying with ASTM C1602.

B. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.5 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

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: 25 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

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1. Use high-range water-reducing 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.

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94 and ASTM C1116, 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.

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3.4 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.

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.

3.5 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.

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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.

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3.6 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.

B. Related Unformed Surfaces:

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

3.7 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 indicated.

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 restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.

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6. Apply a trowel finish to surfaces exposed to view.
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, FF 25; and of levelness, FL 20; with minimum local values of flatness, FF 17; and of levelness, FL 15.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on Drawings. 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.

3.8 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: 3000 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.

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3.9 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.

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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.

3.10 TOLERANCES

A. Conform to ACI 117.

3.11 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s).
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

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.

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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 14 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 receive floor coverings with a repair underlayment.

a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
b. Feather edges to match adjacent floor elevations.

6. 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.

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7. 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.

8. 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: 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.
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, ASTM C39, 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.

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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 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:

    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:

    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.

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4. Air Content: ASTM C231 pressure method, for normal-weight concrete; ASTM C173 volumetric method, for structural lightweight concrete.

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064:

    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:

    a. Cast and laboratory cure two sets of two6-inch by 12-inch or three 4-inch by 8-inch cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C39.

    a. Test one set of 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. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi 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.
10. 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.
11. 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 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.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

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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 liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END

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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. Clay face brick.
3. Structural clay facing tile.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry-joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.
2. Cavity wall insulation.

C. Related Requirements:

1. 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 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.

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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 Verification: For each type and color of the following:

1. Clay face brick, in the form of straps of five or more bricks.
2. Special brick shapes.
3. Weep holes.
4. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. 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.

B. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 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.

1.7 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

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2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

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.

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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 C1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
2. Density Classification: Lightweight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.5 MASONRY LINTELS

A. General: Provide one of the following:

B. 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.

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2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C216.

1. Grade: SW.
2. Type: FBS.
3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi.
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67.
5. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
6. Size (Actual Dimensions): 3-1/2 inches wide by 2-1/4 inches high by 7-1/2 inches long or 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
7. Application: Use where brick is exposed unless otherwise indicated.
8. Cherokee Velour Burgundy (Field Brick) and Cherokee Velour Brown (Accent Brick).

2.7 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91.

B. Water: Potable.

2.8 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615 or ASTM A996, Grade 60 .

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A951.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.187-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, either ladder design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a

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maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches . Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.9 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82, with ASTM A153, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008, Commercial Steel, with ASTM A153, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A36.
4. Stainless Steel Bars: ASTM A276 or ASTM A666, Type 304.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches .
3. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.

2.10 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use the following unless otherwise indicated:

1. Asphalt-Coated Copper Flashing: 7-oz./sq. ft. copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.

B. 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.

C. 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.

D. Termination Bars for Flexible Flashing: Stainless steel bars 1/8 inch by 1 inch.

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

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discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

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.
2. Use masonry cement mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For CMU use Type S.
2. For clay brick use Type N.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:

    a. Clay face brick.

E. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, paragraph 4.2.2 for a specified 28-day strength of 3000 psi.
3. Provide grout with a slump of 10 to 11 inches as measured according to ASTM C143.

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.

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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.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch .
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch .
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet , or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet , 1/4 inch in 20 feet , or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet , 3/8 inch in 20 feet , or 1/2-inch maximum.

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4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet , 1/4 inch in 20 feet , or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet , 3/8 inch in 20 feet , or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch , with a maximum thickness limited to 1/2 inch .
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch .
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch .
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch . Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch .
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs. Lay CMU in stacked bond.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. 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.

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G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. 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.

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches .

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

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3.7 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 as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

3.8 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 FLASHING, WEEP HOLES

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches ; with upper edge tucked under air barrier, lapping at least 4 inches . Fasten upper edge of flexible flashing to sheathing through termination bar.

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4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use open-head joints to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.
3. Space weep holes formed from plastic tubing wicking material16 inches o.c.
4. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
5. Trim wicking material flush with outside face of wall after mortar has set.

D. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches , to maintain drainage.

1. Fill cavities full height by placing pea gravel in cavities as masonry is laid, so that at any point, masonry does not extend more than 24 inches above top of pea gravel.

E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.10 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/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.

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1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.11 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. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

H. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content.

I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

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.

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D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic 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. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END

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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.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Roof deck.

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 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."

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2.2 ROOF DECK

A. 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 A653, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: 1-1/2 inches .
4. Design Uncoated-Steel Thickness: As indicated 0.0295 inch.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.

2.3 ACCESSORIES

A. 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. 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.

E. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

F. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance 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.

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C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members with #12 screws , and as follows:

1. One screw at each flute and at 6-inches on center at roof edges and at ridges and valleys.

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.

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.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

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SECTION 054400

COLD-FORMED METAL TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof trusses.

1.2 DEFINITIONS

A. Structural Component. An individual structural member or element designed to be part of the structure or structural system. This definition of component should not be confused with any other published definitions

B. Structure. The entity to be built.

C. Structural System. A portion of a structure comprising an assembly of structural components which carry and transmit loads.

D. Structural Engineering Documents. The structural drawings, specifications and other documents setting forth the overall design and requirements for the construction, alteration, repair, removal, demolition, arrangement and/or use of the structure, prepared by and signed and sealed by the engineer of record for the structure. Structural engineering documents shall identify the project and specify design criteria both for the overall structure and for structural components and structural systems. The drawings shall identify the nature, magnitude and location of all design loads to be imposed on the structure. The structural engineering documents shall provide construction requirements to indicate the nature and character of the work and to describe, detail, label and define the structure's components, systems, materials, assemblies, and equipment.

E. Structural Submittals. Submittals required by the structural engineering documents which do not require the seal of a professional engineer, such as:

1. Drawings prepared solely to serve as a guide for fabrication and installation and requiring no engineering input such as reinforcing steel shop drawings, and structural steel, steel joist and joist girder erection drawings.
2. Catalog information on standard products not fabricated for a specific project.

F. Structural Delegated Engineering Documents. Documents prepared by a delegated engineer to whom the engineer of record for the structure has delegated responsibility for the design of a structural component or system.

G. Specialty Engineer. A licensed professional engineer, who is not the structural engineer of record, who provides engineering criteria or designs necessary for the structure to be completed. The specialty engineer may be a delegated engineer.

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H. Truss System.

1. Truss System shall mean an assemblage of trusses and truss girders, together with all bracing, connections, and other structural elements and all spacing and locational criteria, that, in combination, function to support the dead, live and wind loads applicable to the roof of a structure with respect to a Truss System for the roof, and the floor of a structure with respect to a Truss System for the floor. A Truss System does not include walls, foundations, or any other structural support systems.
2. “Truss System Engineer” shall mean an engineer who designs a Truss System.
3. “Truss Design Engineer” shall mean an engineer who designs individual trusses but does not design a Truss System

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel truss materials.
2. Post-installed anchors.
3. Mechanical fasteners.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel trusses; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel trusses and for cold-formed truss system.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aegis Metal Framing.
2. MarinoWARE.
3. TrusSteel; an ITW company.
4. USA Frametek.
5. WESTCO Steel Systems, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated

1. Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel trusses.
2. Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel truss system.
3. Where the Specialty Engineer for the design of the truss system is not the same engineer as the Specialty Engineer for the design of the trusses, the Specialty Engineer for the design of the truss system shall review the design submittal for the trusses prior to its submission to the Design Professional and shall indicate in writing that this review has been completed.

B. Structural Performance: Provide cold-formed steel trusses capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:

a. Roof Trusses: Vertical deflection of 1/240 of the span.

3. Design trusses to provide for movement of truss 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.

C. Cold-Formed Steel Truss Standards: Unless more stringent requirements are indicated, trusses shall comply with the following:

1. Roof Systems: AISI S210.
2. Lateral Design: AISI S213.
3. Roof Trusses: AISI S214.

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2.3 COLD-FORMED STEEL TRUSS MATERIALS

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.
2. Coating: G60, A60, AZ50, or GF30.

2.4 ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard steel sections.

1. Connecting Flange Width: 1-5/8 inches, minimum at top and bottom chords connecting to sheathing or other directly fastened construction.
2. Minimum Base-Metal Thickness: 0.0329 inch.

2.5 TRUSS ACCESSORIES

A. Fabricate steel-truss accessories from steel sheet, ASTM A1003, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for truss members.

B. Provide accessories of manufacturer's standard thickness and configuration unless otherwise indicated.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36, zinc coated by hot-dip process according to ASTM A123.

B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel trusses to structure.
2. Type: Use type indicated on the drawings.
3. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

C. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: MIL-P-21035B or SSPC-Paint 20.

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B. Shims: Load-bearing, high-density multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as truss members supported by shims.

2.8 FABRICATION

A. Fabricate cold-formed steel trusses 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 trusses using jigs or templates.
2. Cut truss members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel truss members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

4. Fasten other materials to cold-formed steel trusses by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses 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 truss 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 truss to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting trusses and 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 INSTALLATION

A. Install bridge, and brace cold-formed steel trusses according to AISI S200, AISI S202, AISI S214, and manufacturer's written instructions unless more stringent requirements are indicated.

1. Coordinate with wall framing to align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure.

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2. Anchor trusses securely at all bearing points.
3. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to CFSEI's Technical Note 551e, "Design Guide: Permanent Bracing of Cold-Formed Steel Trusses."

B. Install cold-formed steel trusses and accessories true to line and location, and with connections securely fastened.

1. Erect trusses with plane of truss webs plumb and parallel to each other. Align and accurately position trusses at required spacings.
2. Erect trusses without damaging truss members or connections.
3. Fasten cold-formed steel trusses by welding or mechanical fasteners.

a. Comply with AWS D1.3 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.

C. Install temporary bracing and supports to secure trusses 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 trusses are secured.

D. Truss Spacing: As indicated on Drawings.

E. Do not alter, cut, or remove truss members or connections of trusses.

3.3 ERECTION TOLERANCES

A. Install cold-formed steel trusses 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 trusses no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel trusses with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Special Inspector shall review fabricator's quality control procedures and review reports prepared by the fabricator.

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B. Cold-formed metal trusses will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel trusses are without damage or deterioration at time of Substantial Completion.

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SECTION 055000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for overhead doors and grilles.
2. Steel framing and supports for countertops.
3. Steel framing and supports for equipment.
4. Steel tube reinforcement for low partitions.
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. Miscellaneous steel trim including steel angle corner guards.
8. Metal bollards.
9. Abrasive metal nosings.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts and steel pipe sleeves indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. 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 overhead doors and grilles.
2. Steel framing and supports for countertops.
3. Steel tube reinforcement for low partitions.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Miscellaneous steel trim including steel angle corner guards.
7. Metal bollards.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1, "Structural Welding Code - Steel."

1.5 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 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.

C. Steel Pipe: ASTM A53, Standard Weight (Schedule 40) unless otherwise indicated.

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2.2 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, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum and stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy.

E. 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.

F. 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, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.

2.3 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with

B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

2.4 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.

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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.

2.5 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. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.6 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.

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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. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.7 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

1. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
2. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.

B. Prime steel bollards with zinc-rich primer.

2.8 ABRASIVE METAL NOSINGS

A. Cast-Metal Units: Cast, with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Source Limitations: Obtain units from single source from single manufacturer.
2. Nosings: Cross-hatched units, 1-1/2 by 1-1/2 inches, for casting into concrete.

B. Extruded Units: with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Source Limitations: Obtain units from single source from single manufacturer.
2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
3. Provide solid-abrasive-type units without ribs.
4. Nosings:

a. Square-back units, 3 inches wide, for casting into concrete steps.

C. Apply bituminous paint to concealed surfaces of cast-metal units.

D. Apply clear lacquer to concealed surfaces of extruded units.

2.9 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

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2.10 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.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel and iron hardware and with ASTM A123 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 unless zinc-rich primer is indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

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. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. 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.

2.12 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

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PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for overhead doors and overhead grilles securely to, and rigidly brace from, building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

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D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLATION OF METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

1. Do not fill removable bollards with concrete.

B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete in formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

C. 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.

D. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards 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 REPAIRS

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END

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SECTION 061000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood blocking and nailers.
2. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.
2. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. 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.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

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1.4 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:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Post-installed anchors.
7. Metal framing anchors.

1.5 QUALITY ASSURANCE

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: 15 percent unless otherwise indicated.

C. Engineered Wood Products: Acceptable to the Design Professional and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

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2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC4a for all items indicated to be preservative-treated.

1. Preservative Chemicals: Acceptable to the Design Professional and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Cants.
4. Furring.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, **fire-retardant treated,** in thickness indicated or, if not indicated, not less than **3/4-inch (19-mm)** nominal thickness.

2.5 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

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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 of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to the Design Professional, based on ICC-ES AC70.

2.6 METAL FRAMING ANCHORS

A. Provide products as indicated on the drawings from one of the following manufacturers:

1. KC Metal Products, Inc., 1960 Hartog Dr., San Jose, CA 95131 (408) 436-8754.

2. Simpson Strong-Tie Company, Inc., 2221 Country Lane, McKinney, TX 75069, (972) 542-0326.

3. Mitek-USP, USP/MiTek US Largo, FL, 11910 62nd Street, North Largo, FL.

4. Advanced Connector Systems, 1551 West 960 North, Orem, UT 84005 (801) 735-1178.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

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. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

C. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

D. Do not splice structural members between supports unless otherwise indicated.

E. 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.

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F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

G. 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.

H. 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.

I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

J. 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. Evaluation report for fastener.

K. 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.

L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD 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.

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B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END

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SECTION 061600

SHEATHING

PART 3 - GENERAL

3.01 RELATED DOCUMENTS

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

4.02 SUMMARY

A. Section Includes:
   1. Wall sheathing.

B. Related Requirements:
   1. Section 061000 "Rough Carpentry"

5.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **Project site**.
   1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

7.01 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
   4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

A. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.
   1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
   2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   3. Include details of interfaces with other materials that form part of air barrier.

8.02 INFORMATIONAL SUBMITTALS

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A. Qualification Data: For Installer. including list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

A. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

B. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

C. Evaluation Reports: For the following, from ICC-ES:
   1. Fire-retardant-treated plywood.
   2. Air-barrier and water-resistant glass-mat gypsum sheathing.

11.02 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.

A. Mockups: Build mockups to set quality standards for materials and execution.
   1. Build integrated mockups of exterior wall assembly incorporating backup wall construction, window, storefront, door frame and sill, ties and other penetrations, and flashing to demonstrate crack and joint treatment and sealing of gaps, terminations, and penetrations of air-barrier sheathing assembly.
      a) Coordinate construction of mockups to permit inspection of sheathing 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 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.

B. 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.

14.02 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 15 - PRODUCTS

15.01 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.

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15.02 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

15.03 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. 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 D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings:]

15.04 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.

1. Acceptable Manufacturers:
   a) Continental Building Products, LLC (Weather Defense)
   b) Georgia Pacific Gypsum, LLC (Densglas)
   c) National Gypsum Company (Gold Bond eXP)
2. Type and Thickness: Regular, **1/2 inch (13 mm),** Type X, **5/8 inch (15.9 mm)** thick.
3. Size: **48 by 96 inches (1219 by 2438 mm)** for vertical installation.

16.01 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof, parapet, and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M] [of Type 304 stainless steel].

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

E. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C1002.

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2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C954.

16.02 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with **APA AFG-01** that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 17 - EXECUTION

17.01 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. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate **wall, parapet, and roof** sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

17.02 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with **screws**.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
4. Install panels with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.

C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.

17.03 FIELD QUALITY CONTROL

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A. Inspections: Air-barrier and water-resistant glass-mat gypsum sheathing, accessories, and installation are subject to inspection for compliance with requirements. **Inspections may include the following:**
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
   3. Termination mastic has been applied on cut edges.
   4. Strips and transition strips have been firmly adhered to substrate.
   5. Compatible materials have been used.
   6. Transitions at changes in direction and structural support at gaps have been provided.
   7. Connections between assemblies (sheathing and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
   8. All penetrations have been sealed.

B. Air barriers will be considered defective if they do not pass inspections.

C. Prepare inspection reports.

END OF SECTION 061600

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SECTION 064113

ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

A. AWI Quality Standard: Comply with requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI), Seventh Edition (1997), except as otherwise indicated on the drawings.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each product and process specified as work of this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

B. Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components.

C. Samples: Submit the following samples:

1. Exposed cabinet hardware, one unit of each type and finish.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver woodwork until painting, wet work, grinding operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other installation areas, store only in areas meeting requirements specified for installation areas.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide high pressure decorative laminates of one of the following:

1. Formica Corp.
2. Nevamar Decorative Surfaces
3. Pioneer Plastics, Corp.
4. Wilson-Art International, Inc.

2.02 FABRICATION, GENERAL

A. Fabricate woodwork to dimensions, profiles, and details indicated on the drawings with openings and mortises precut to receive hardware and other items and work.

B. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site to maximum extent possible. Disassemble components only for shipment and installation. For fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Pre-cut Openings: Fabricate architectural woodwork with pre-cut openings to receive hardware, appliances, plumbing fixtures, and electrical work. Locate openings and use templates or roughing in diagrams for size and shape. Smooth edges of cutoffs and, where located in countertops, seal edges of cutouts with a water-resist coating.

D. Measurements: Before proceeding with fabrication of woodwork to be fitted to other construction, obtain field measurements and verify dimensions and shop drawings and details for accurate fit.

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2.03 ARCHITECTURAL CABINETS, WOOD

A. Quality Standard: Comply with AWI Section 400 and its Division 400A "Wood Cabinets", plus the following requirements B and C.

B. All wood used in cabinet construction shall be plywood of solid wood veneers or solid wood. Particle and flake board products shall not be used.

C. Wood cabinets for transparent finish: Comply with the following requirements:

1. Grade: Custom.
2. Wood species for exposed surfaces: Plain Sliced White Maple.
3. Wood species for semi-exposed surfaces: Match species and cut indicated for exposed surfaces.

2.04 CABINET HARDWARE

A. Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items which are specified in Division 8, Section 0870, "Finish Hardware".

B. Cabinet hardware schedule shall include, but is not limited to the following:

1. Typical Hardware: Approved Manufacturers: KV, Accurid, Grant
   a) Door and drawer pulls - Stanley 4484-1/2, US 26, KV, Grant
   b) Hinges - Self-closing, Blum 180^{o}, Stanley, KV
   c) Drawer slides - KV 1300, Stanley, Grant
   d) Adjustable standards and shelf supports - KV 255 x 256, Grant, Accurid
   e) Adjustable standards with brackets - KV 87ANO x 186,10", Accurid,Grant
   f) Door locks - See Finish Hardware Set 27.
   g) Base Cabinet Doors Locks: Knape & Vogt No. 986 lock each leaf, key each space alike, Stanley, Grant.
   h) Pocket door hinge: Knape & Vogt No. 8092P, Stanley, Grant.

2.05 ARCHITECTURAL CABINET TOPS

A. Quality Standard: Comply with AWI Section 400 and its Division 400C, plus the following requirement B through F.

B. Type of Top: High Pressure Decorative Laminate.

C. Grade: Custom

D. Laminate cladding for horizontal surface: high pressure decoration laminate complying with NEMA SL 3 matching selections indicated on drawings, grade GP-50 (0.050" nominal thickness).

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Colors: Exterior faces and edges; colors shown on the drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

3.02 INSTALLATION

A. Install woodwork plumb, level, true and straight with no distortions. Shims using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including tops); and with no variations in flushness of adjoining surfaces.

B. Scribe and cut woodwork to anchors or blocking built-in or attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing.

C. Anchor woodwork to anchors or blocking built-in or attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners

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and blind nailing.

D. Cabinets: Install without distortion so that doors and drawers fit openings and are aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

E. Tops: Anchor to base units and other support systems as indicated on the drawings.

3.03 ADJUSTMENT, CLEANING, FINISHING, AND PROTECTION

A. Repair damaged and defective woodwork to eliminate defects or replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.

END.

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SECTION 072100

THERMAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Extruded polystyrene foam-plastic board
   2. Polyisocyanurate foam-plastic board
   3. Glass-fiber blanket.

B. Related Requirements:
   1. Section 042000 "Unit Masonry" for insulation installed in masonry cells.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.05 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

2.01 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded Polystyrene Board, Type IV (Cavity Walls): ASTM C578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.
   1. Acceptable Products:
      a) Kingspan Green Guard
      b) Dupont CavityMate Plus
      c) Owens Corning Foamular 250
   2. Applications:
      a) Exterior Concrete and Masonry Walls: (Applied to exterior face of masonry)
         1) Thickness: 2”
         2) R-Value: min. 10
      b) Exterior Stud Walls with Cavity (Applied to exterior face of sheathing)

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1) Thickness: 1” uno
2) R-Value: min. 5

3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.02 POLYISOCYANURATE FOAM-PLASTIC BOARD

A. Acceptable Manufacturers:
1. GAF
2. Carlisle Construction Materials
3. Firestone Building Products
4. Johns Manville

B. Polyisocyanurate Board, (Roofing over Metal Deck): ASTM C1289, foil faced on exposed side, Type I, Class 1 or 2.
1. R-Value: min. 20
2. Thickness: (2) layers 1.55” each
3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.03 GLASS-FIBER BLANKET

A. Acceptable Manufacturers:
1. Owens Corning
2. Certainteed
3. Johns Manville

B. Applications:
1. Exterior Stud Walls: Batt Type:
a) Thickness: As indicated on the drawings.
b) R-Value 3.50”=R-15, 6.25”=R-19
c) Vapor Retarder: Kraft facing.
2. Attic/Ceiling Rafters: Batt Type
a) Thickness: As required to achieve R-38.
b) Vapor Retarder: Separate

C. Glass-Fiber Blanket: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.
1. Application: Interior stud walls where indicated on drawings.
2. Thickness: 3.50”

D. Glass-Fiber Blanket, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
1. Application: Metal building insulation.
2. Thickness: Walls – 6”, Roof – 8”.

E. Glass-Fiber Blanket, Kraft Faced: ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).
1. All exterior stud walls.
2. Thickness: Math stud thickness (4” stud = 3.50” batt, 6” stud = 5.25” batt)

F. Glass-Fiber Blanket, Reinforced-Foil Faced: ASTM C665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim kraft.
1. Application: Metal building insulation.
2. Thickness: Walls – 6”, Roof – 8”.

2.04 ACCESSORIES

A. Insulation for Miscellaneous Voids:
1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.

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2. 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.

PART 3 - EXECUTION

3.01 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.

3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.03 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer.

1. Fit courses of insulation between **wall ties and other** obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3.04 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
   a) Exterior Walls: Set units with facing placed toward **exterior of construction**.
   b) Interior Walls: Set units with facing placed **toward areas of high humidity**.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

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1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.05 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

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SECTION 072600

VAPOR RETARDERS

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
1. Reinforced-polyethylene vapor retarders.
2. Fire-retardant, reinforced-polyethylene vapor retarders.

1.03 ACTION SUBMITTALS
A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS
A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.01 REINFORCED-POLYETHYLENE VAPOR RETARDERS
A. Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than **20 lb/1000 sq. ft. (9 kg/100 sq. m)**, with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).
1. Thickness (min.) 12 mil
2. Must exceed requirements of ASTM E-1745

2.02 ACCESSORIES
A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

PART 3 - EXECUTION

3.01 PREPARATION
A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.02 INSTALLATION OF VAPOR RETARDERS
A. Install vapor retarders over prepared grade. Lap joints a minimum of 12 inches (305 mm) and seal with manufacturer's recommended tape. Install second layer over pathways to equipment.
B. Seal around penetrations such as utilities and columns in order to create a monolithic, airtight membrane at grade surface, perimeter, and all vertical penetrations.

3.03 PROTECTION
A. Protect vapor retarders from damage until concealed by permanent construction.

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SECTION 072726

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Vapor-retarding, fluid-applied air barriers.
   2. Vapor-permeable, fluid-applied air barriers.

B. Related Requirements:
   1. Section 042000 “Unit Masonry”.
   2. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.03 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.

1.04 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.

1.05 REFERENCES

A. Building Code and Material Evaluation Service Standards
   1. ICC ES AC 212 – March 1, 2005, ICC Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing
   2. May, 1997, CCMC (Canadian Construction Materials Centre) Technical Guide for Air Barrier Material
   3. 2009 IBC, International Building Code
   4. 2009 IRC, International Residential Code
   5. 2009 IECC, International Energy Conservation Code

B. ASTM Standards
   1. C 297-94, Test Method for Tensile Strength of Flat Sandwich Constructions in Flat wise Plane
   2. C 1177-08, Specification for Glass Mat Gypsum Substrate for Use as Sheathing
   3. D 522-93a, Test Methods for Mandrel Bend Test of Attached Organic Coatings
   4. D 1970-00, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
   5. D 3273-00, Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

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6. D 4541-09, Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
7. E 84-98, Test Method for Surface Burning Characteristics of Building Materials
8. E 96-00, Test Method for Water Vapor Transmission of Materials
9. E 779-10, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
10. E 783-02, Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
11. E 1186-03 (2009), Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
12. E 1827-96 (2007), Standard Test Methods for Determining Air tightness of Buildings Using an Orifice Blower Door
13. E 2178-03, Test Method for Air Permeance of Building Materials
14. E 2357-05, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

C. APA – The Engineered Wood Association
   1. E30U-2007, Engineered Wood Construction Guide

D. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
   1. 2005 ASHRAE Handbook--Fundamentals
   2. ASHRAE 90.1 – 2010, Energy Standard for Buildings Except Low-Rise Residential Buildings
   3. ASHRAE 189.1 – 2009, Standard for the Design of High Performance Green Buildings Except Low-Rise Residential Buildings

E. South Coast Air Quality Management District (SCAQMD)
   1. Rule 1113 (2007) – Architectural Coatings

1.06 COORDINATION/SCHEDULING

A. Coordinate installation of foundation waterproofing, roofing membrane, windows, doors and other wall penetrations to provide a continuous air barrier.
B. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall.
C. Provide sill flashing to direct water to the exterior before windows and doors are installed.
D. Install window and door head flashing immediately after windows and doors are installed.
E. Install diverter flashings wherever water can enter the assembly to direct water to the exterior.
F. Install parapet cap flashing and similar flashing at copings and sill to prevent water entry into the wall assembly.
G. Install cladding within 60 days of waterproof air barrier installation.

1.07 SUBMITTALS

A. Manufacturer’s specifications, details and product data.
B. Manufacturer’s standard warranty.
C. Manufacturer’s ICC evaluation report confirming compliance with the IBC, IRC, and IECC as an air barrier and water-resistive barrier.
D. Samples for approval as directed by architect or owner.
E. Shop drawings: substrate joints, cracks, flashing transitions, penetrations, corners, terminations, and tie-ins with adjoining construction, interfaces with separate materials that form part of the air barrier assembly.

1.08 QUALITY ASSURANCE

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A. Manufacturer requirements
   1. Manufacturer of exterior wall waterproofing and air barrier materials for a minimum of 30 years in North America.
   2. ISO 9001:2000 Certified Quality System and ISO 14001:2004 Certified Environmental Management System.

B. Contractor requirements
   1. Knowledgeable in the proper use and handling of materials.
   2. Employ skilled mechanics who are experienced and knowledgeable in waterproofing and air barrier application, and familiar with the requirements of the specified work.
   3. Provide the proper equipment, manpower and supervision on the job-site to install the air barrier assembly in compliance with the project plans & specifications, shop drawings, and manufacturer's published specifications and details.

C. Regulatory Compliance
   1. Primary air barrier and joint treatment reinforcement materials:
      a) Listed by IBC and recognized for use on all types of construction.
      b) Listed by CCMC and recognized for use on all types of construction.
      c) Comply with VOC requirements of SCAQMD Rule 1113.
      d) Comply with ASHRAE 90.1 – 2010
      e) Comply with ASHRAE 189.1 - 2009

D. Mock-ups
   1. Build stand-alone site mock up or sample wall area on as-built construction to incorporate back-up wall construction, typical details covering substrate joints, cracks, flashing transitions, penetrations, corners, terminations, tie-ins with adjoining construction, and interfaces with separate materials that form part of the air barrier assembly.

1.09 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product.

B. Protect coatings (pail products) from freezing temperatures and temperatures in excess of 90 degrees F (32 degrees C). Store away from direct sunlight.

C. Protect Portland cement based materials (bag products) from moisture and humidity. Store under cover off the ground in a dry location.

D. Protect and store accessory and auxiliary products in accordance with manufacturer's written instructions.

1.10 PROJECT/SITE CONDITIONS

A. Maintain ambient and surface temperatures above 40 degrees F (4 degrees C) during application and drying period, minimum 24 hours after application of waterproof air barrier materials.

B. Provide supplementary heat for installation in temperatures less than 40 degrees F (4 degrees C) or if surface temperature is likely to fall below 40 degrees F (4 degrees C).

C. Provide protection of surrounding areas and adjacent surfaces from application of materials.

1.11 WARRANTY

A. Provide manufacturer's standard warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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A. Approved Manufacturers:
   1. Sto Corp.
   2. Dupont
   3. BASF

B. Obtain primary air barrier and accessory air barrier materials from single source.

2.02 MATERIALS

A. Primary Air Barrier Material Basis of design is: StoGuard with Sto EmeraldCoat - ready-mixed flexible spray or roller applied waterproof air barrier membrane material.
   1. Other approved manufacturers as listed in 2.1.A.

B. Accessory Materials
   1. Joint Treatments
      a) Sto Gold Fill® with StoGuard Mesh: ready mixed flexible trowel or spray applied air barrier material.
      b) StoGuard® Rapid Seal™ with StoGuard Mesh: moisture cure elastomeric waterproof air barrier material.
      c) Sto EmeraldCoat with StoGuard Fabric: flexible waterproof air barrier membrane material.
   2. Joint Reinforcements
      a) StoGuard Mesh: nominal 4.2 oz/yd^2 (142 g/m^2) self-adhesive, flexible, symmetrical, interlaced glass fiber reinforcing mesh, with alkaline resistant coating for compatibility with Sto materials.
      b) StoGuard Fabric: non-woven integrally reinforced cloth reinforcement.
      c) StoGuard RediCorner™: non-woven integrally reinforced preformed cloth.
   3. Transition Membranes
      a) Sto Gold Fill with StoGuard Mesh: ready mixed flexible trowel or spray applied air barrier material with treated glass fiber reinforcing mesh.
      b) StoGuard RapidSeal or StoGuard RapidSeal with StoGuard Mesh: moisture cure elastomeric waterproof air barrier material with treated glass fiber reinforcing mesh (where applicable).
      c) Sto VaporSeal with StoGuard Fabric: flexible waterproof air barrier membrane material with non-woven integrally reinforced cloth.
      d) StoGuard Tape: self adhering rubberized asphalt tape with polyester fabric facing.
   4. Primers
      a) StoGuard Primer: rubber resin emulsion primer for use with StoGuard Tape to enhance adhesion and allow installation down to 35 degrees F (1.7 degrees C).

C. Auxiliary Materials *(by others)*
   1. Wet sealant: Dow Corning 790, 791, and 795 sealants
   2. Pre-cured sealant tape: Dow 123
   3. Spray adhesive: 3M Super 77 Spray Adhesive
   4. Spray foam: Dow Great Stuff for Gaps and Cracks

D. Patch and Leveling Material for Concrete and Masonry
   1. Sto Leveler: polymer modified cementitious patch and leveling material for prepared concrete and masonry surfaces up to 3/8 inch (10 mm).
   2. Sto BTS-Xtra: polymer modified lightweight cementitious patch and leveling material for prepared concrete and masonry surfaces up to 1/8 inch (3 mm).

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2.03 PERFORMANCE REQUIREMENTS

A. Durability, resistance to aging, water and water penetration resistance, structural loading: joint treatment and primary air barrier material, comply with ICC ES AC 212

B. Flexibility: ASTM D 522, primary air barrier material, no cracking or delamination before and after aging using 1/8 inch (3 mm) mandrel at 14º F (10º C)

C. Nail sealability: ASTM D 1970, 7.9.1, primary air barrier passes

D. Material air leakage: ASTM D 2178, primary air barrier and joint treatment $\leq$ 0.004 cfm/ft^2 at 1.57 psf (0.02 L/s·m^2 at 75 Pa)

E. Resistance to mold: ASTM D 3273, no mold growth after 28 day exposure

F. Adhesion: joint treatment and primary air barrier material, ASTM C 297 or D 4541, $\geq$ 30 psi (207 kPa), or exceeds strength of glass mat facing on glass mat gypsum substrates

G. Surface burning: ASTM E 84, joint treatment and primary air barrier material flame spread $\leq$ 25, smoke developed $\leq$ 450, Class A building material

H. Water vapor permeance: ASTM E 96 Method B, > 10 perms (570 ng/Pa·s·m^2)

I. Assembly air leakage: ASTM E 2357, $\leq$ 0.04 cfm/ft^2 (0.2 L/s·m^2) air leakage after conditioning protocol

J. Field adhesion testing: ASTM D 4541, $\geq$ 30 psi (207 kPA) or exceeds strength of glass mat facing on glass mat gypsum substrates

K. Building envelope air leakage: ASTM E 779 or 1827, $\leq$ 0.4 cfm/ft^2 (2 L/s·m^2)

L. Volatile Organic Compounds: SCAQMD Rule 1113, joint treatment and primary air barrier material $\leq$ 100 g/L

M. Water-resistive barrier: ICC ES AC 212, joint treatment and primary air barrier comply and are listed in a valid ICC ESR

2.04 DESIGN CRITERIA

A. Structural

1. Design for maximum allowable deflection normal to the plane of the wall: L/240.
2. Design for wind load in conformance with code requirements.

B. Moisture Control

1. Prevent the accumulation of water in the wall assembly and behind the exterior wall cladding:
   a) Minimize condensation within the assembly.
   b) Drain water directly to the exterior where it is likely to penetrate components in the wall assembly (windows and doors, for example).
   c) Provide corrosion resistant flashing to direct water to the exterior in accordance with code requirements, including: above window and door heads, beneath window and door sills, at roof/wall intersections, floor lines, decks, intersections of lower walls with higher walls, and at the base of the wall.

C. Air Barrier Continuity: provide continuous air barrier assembly of compatible air barrier components.

D. Substrates

1. Concrete Masonry Units: provide normal weight units with flush joints (struck flush with the surface) and allow for a minimum of 2 coats of the primary air barrier material, or a cementitious parge coat to fill and level irregular surfaces and 1 coat of the primary air barrier material, prior to the air barrier application, such that a void and pinhole free air barrier surface is achieved.

E. Mechanical Ventilation: maintain pressurization and indoor humidity levels in accordance with recommendations of ASHRAE (see 2005 ASHRAE Handbook—Fundamentals).

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PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect concrete and concrete masonry surfaces for:
   1. Contamination — algae, dirt, dust, efflorescence, form oil, fungus, grease, mildew or other foreign substances.
   2. Surface deficiencies – weak, friable, chalkiness, laitance, bugholes, and spalls.
   3. Cracks — measure crack width and record location of cracks.
   4. Damage or deterioration.
   5. Moisture content and moisture damage — use a moisture meter to determine if the surface is dry enough to receive the waterproof air barrier and record any areas of moisture damage or excess moisture.
   6. Flush masonry mortar joints completely filled with mortar.

B. Inspect sheathing application for compliance with applicable requirement:
   1. Glass mat faced gypsum sheathing in compliance with ASTM C 1177: consult manufacturer's published recommendations and ICC ES Report. Conform with project requirements for wind load resistance.

C. Report deviations from the requirements of project specifications or other conditions that might adversely affect the waterproof air barrier installation. Do not start work until deviations are corrected.

3.02 SURFACE PREPARATION

A. Concrete Masonry
   1. Remove surface contamination and weak surface conditions. Use chemical cleaners such as TSP (trisodium phosphate) detergent to remove oil and grease and rinse with potable water. Use chemical cleaners to remove efflorescence or other surface contamination in accordance with manufacturer's written instructions. Use mechanical methods such as waterblasting, sandblasting, and wire brushing to remove weak surface conditions.
   2. Repair cracks up to 1/8 inch (3 mm) wide by raking with a sharp tool to remove loose, friable material and blow clean with oil-free compressed air. Apply joint treatment material over crack, embed reinforcement (where applicable), and smooth joint treatment material with a trowel, drywall or putty knife to cover the reinforcement.
   3. Remove projecting fins, ridges, and mortar by mechanical means. Remove excess mortar from masonry ties, lintels and shelf angles.
   4. Fill honeycombs, aggregate pockets, holes and other voids with patching material.

B. Sheathing
   1. Remove and replace damaged sheathing.
   2. Spot surface defects such as over-driven fasteners, knot holes, or other voids in sheathing with knife grade joint treatment material.
   3. Spot fasteners with knife grade or coating joint treatment material.

3.03 INSTALLATION

A. Coordinate work with other trades to ensure air barrier continuity with connections at foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line.

B. Rough opening protection:
   1. Install transition membrane into and around rough opening.

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C. Sheathing joints
   1. Install joint treatment material with applicable reinforcement over sheathing joints.

D. Transitions
   1. Install air barrier accessory materials (with reinforcement where applicable), or auxiliary material at transition areas: foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line.

E. Waterproof air barrier membrane
   1. Concrete – install one coat of Sto EmeraldCoat by spray or roller in a uniform, continuous wet film of 10 mils to the prepared concrete substrate. Do not install over working or moving joint sealants.
   2. Concrete Masonry - install one liberal coat of Sto EmeraldCoat by spray or roller in a uniform, continuous film to the prepared concrete masonry substrate. Backroll spray applications. Allow to dry. Install a second liberal coat in a uniform, continuous film, and backroll spray applications, to achieve a void and pinhole free surface. Depending on the condition of the surface a minimum of 10 wet mils up to a maximum of 30 wet mils per coat is required. Apply additional coats if needed to achieve a void and pinhole free surface. Do not install over working or moving joint sealants.

      IMPORTANT NOTE: The number of coats and thickness is highly dependent on CMU composition, unit weight (lightweight or normal weight), porosity, joint profile, and other variables that may exist. For “rough” CMU wall surfaces skim coat the entire wall surface with the leveling material to fill and level the surface prior to applying the waterproof air barrier membrane and transition materials. When a skim coat of the leveling material is installed only one coat of the waterproof air barrier membrane is typically required. Use the mock-up and site tests as the basis for the work.
   3. Sheathing
      a) Glass mat faced gypsum sheathing: install one coat of Sto EmeraldCoat by spray or roller in a uniform, continuous film of 10 wet mils to the prepared glass mat gypsum substrate to achieve a void and pinhole free surface. Do not install over working or moving joint sealants.

3.04 FIELD QUALITY CONTROL

A. Owner’s qualified testing agency shall perform inspections and tests.

B. Inspections: air barrier materials are subject to inspection to verify compliance with requirements.
   1. Condition of substrates and substrate preparation.
   2. Installation of primary air barrier material, accessory materials, and compatible auxiliary materials over structurally sound substrates and in conformance with architectural design details, contractor’s shop drawings, project mock-up, and manufacturer’s written installation instructions.
   3. Air barrier continuity and connections without gaps and holes at foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line.

C. Tests: air barrier materials and assembly are subject to tests to verify compliance with performance requirements:

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1. Qualitative air leakage test: ASTM E 1186
2. Quantitative air leakage test: ASTM E 779, E 783, and E 1827
3. Adhesion test: ASTM D 4541
4. Qualitative adhesion and compatibility testing: wet sealant manufacturer's field quality control adhesion test

D. Repair non-conforming substrates and air barrier material installation to conform with project requirements.

E. Take corrective action to repair and replace, reinstall, seal openings, gaps, or other sources of air leakage to conform with project performance requirements.

3.05 PROTECTION AND CLEANING

A. Protect air barrier materials from damage during construction caused by wind, rain, freezing, continuous high humidity, or prolonged exposure to sun light.

B. Protect air barrier materials from damage from trades, vandals, and water infiltration during construction.

C. Repair damaged materials to meet project specification requirements.

D. Clean spills, stains, soiling from finishes or other construction materials that will be exposed in the completed work with compatible cleaners.

E. Remove all masking materials after work is completed.

END OF SECTION 072726

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SECTION 074113

STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes standing-seam metal roof panels.

B. Related Sections:

1. Section 074293 "Soffit Panels" for metal panels used in horizontal soffit applications.

1.03 PREINSTALLATION MEETINGS

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

1. Meet with Owner, Architect, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal 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 structural loading limitations of **deck, purlins, and rafters** during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

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D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.05 INFORMATIONAL SUBMITTALS
A. Qualification Data: For Installer.
B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
C. Field quality-control reports.
D. Sample Warranties: For special warranties.

1.06 CLOSEOUT SUBMITTALS
A. Maintenance Data: For metal panels to include in maintenance manuals.

1.07 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 demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockups for typical roof area only, including accessories.
      a) Size: **12 feet (3.5 m) long by 6 feet (1.75 m)**.
   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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING
A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
D. Retain strippable protective covering on metal panels during installation.
E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.09 FIELD CONDITIONS
A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION
A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

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A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. 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. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a) Color fading more than 5 Hunter 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.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
   1. Warranty Period: **20** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for **low and/or steep**-slope roof products.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
   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.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E1680[**or ASTM E283**] at the following test-pressure difference:
   1. Test-Pressure Difference: **1.57 lbf/sq. ft. (75 Pa)**.

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 **or ASTM E331** at the following test-pressure difference:

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.

2.02 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

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1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.
2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1637.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and **intermediate stiffening ribs symmetrically spaced** between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
1. Approved Manufacturers:
   a) MBCI
   b) Fabral
   c) Architectural Metal Systems
   d) Architectural Integrated Metals, Inc.
   e) PAC-CLAD (Peterson), A Carlisle Company.
2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
   a) Nominal Thickness: 0.024 inch (0.609 mm) (24 gauge)
   b) Exterior Finish:**Three-coat fluoropolymer**.
   c) Color: **As selected by Architect from manufacturer's full range**.
3. Clips: **Two-piece floating** to accommodate thermal movement.
   a) Material: **0.064-inch- (1.63-mm-)** nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
4. Joint Type: Single folded.
5. Panel Coverage: **16 inches (406 mm)**.
6. Panel Height: **2.0 inches (51 mm)**.

2.03 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils (0.76 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D1970.

2.04 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.

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2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match **metal roof panels, roof fascia, and rake trim** unless noted otherwise.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Panel Fasteners: Self-tapping screws designed to withstand design loads.

G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.05 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

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.

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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 nonexpansion, 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 panel manufacturer for application, but not less than thickness of metal being secured.

2.06 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 unacceptable. 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. Steel Panels and Accessories:
   1. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Concealed Finish: Apply pretreatment and 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 (0.013 mm).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
   2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof 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 systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.02 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.03 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated **below**, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm) Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.
   a) Rake edges for a distance of **18 inches (460 mm)**.
   b) Hips and ridges for a distance on each side of **12 inches (305 mm)**.
   c) Roof-to-wall intersections for a distance from wall of **18 inches (460 mm).**
   d) Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of **18 inches (460 mm)** .

B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.04 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal 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 panels.
2. Flash and seal metal 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 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 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 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.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. 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.
3. Copper Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
4. Stainless-Steel Panels: Use stainless-steel fasteners.

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C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
   1. Install clips to supports with self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
   3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

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 will be permanently watertight and weather resistant.
   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 achieve waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
   1. Provide elbows at base of downspouts to direct water away from building.
   2. Connect downspouts to underground drainage system where indicated.

J. Roof Curbs: Install flashing around bases where they meet metal roof panels.

K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.05 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated

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and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.06 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113

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SECTION 074293

SOFFIT PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes metal soffit panels.

B. Related Sections:

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Manufacturer Qualifications: Minimum of 5 years experience in manufacturing metal panels similar to those specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

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E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.08 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.09 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. 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. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a) Color fading more than 5 Hunter 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

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
   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**] [**1/240**] <**Insert deflection**> of the span.
   4. <Insert serviceability requirements>.
   5. Test-Pressure Difference: **1.57 lbf/sq. ft. (75 Pa)**.

B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
   1. Test-Pressure Difference: **2.86 lbf/sq. ft. (137 Pa)**.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.

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2.02 METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Flush-Profile Metal Soffit Panels **Solid** panels formed with vertical panel edges and **a flat pan** between panel edges; with flush joint between panels.

1. Acceptable Manufacturers:
   a) Firestone Building Products, Inc.
   b) PAC-Clad, Peterson Aluminum Corporation
   c) Centria Architectural Systems, Inc.
2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
   a) Nominal Thickness: 24 gauge
   b) Exterior Finish: **Two-coat fluoropolymer**
   c) Color: **As selected by Architect from manufacturer's full range**.
3. Panel Coverage: **12 inches (305 mm)**.
4. Panel Height: **1.0 inch (25 mm)**.

2.03 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-(25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in

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metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.04 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. 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 nonexpansion, 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.

2.05 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. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine 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 panel manufacturer.

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2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
    a) Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.03 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal 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 panels.
    2. Flash and seal metal 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 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 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. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
    1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
    2. 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.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
    1. Apply panels and associated items true to line for neat and weathertight enclosure.
    2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
    3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
    4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

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E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

F. 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 achieve waterproof performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.04 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074293

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SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Manufactured reglets **with counterflashing**.
   2. Formed roof-drainage sheet metal fabrications.
   3. Formed steep-slope roof sheet metal fabrications.
   4. Formed wall sheet metal fabrications.

B. Related Requirements:
   1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Section 077100 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, reglets, and counterflashings.
   3. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.03 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.

1.04 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.

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C. Samples for Verification: For each type of exposed finish.
1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.05 INFORMATIONAL SUBMITTALS
A. Qualification Data: For fabricator.
B. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS
A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
B. Special warranty.

1.07 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 **and FM Approvals approved**, shop shall be listed as able to fabricate required details as tested and approved.

1.08 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.

1.09 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

2.01 PERFORMANCE REQUIREMENTS

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A. General: 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. FM Approvals Listing: Manufacture and install **copings and roof edge flashings** that are listed in FM Approvals' "RoofNav" and approved for windstorm classification as listed within FM Loss Prevention Data Sheet 1-49. Identify materials with name of fabricator and design approved by FM Approvals.

D. 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 (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.

2.02 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with [**smooth, flat**] [**embossed**] surface.

1. Exposed Coil-Coated Finish:

a) Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.

3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and

2.03 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal 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.

c) Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

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2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C920, elastomeric **polyurethane** polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

F. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

G. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.

1. Acceptable Manufacturers:
   a) Fry Reglet Corporation
   b) W.P. Hickman Co.
   c) Keystone Flashing Company
2. Source Limitations: Obtain reglets from single source from single manufacturer.
3. Material: Galvanized steel, **0.022 inch (0.56 mm)** 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. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
6. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
7. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
8. 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.
9. Finish: With manufacturer's standard color coating.

2.04 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.

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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 (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

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 (25 mm) 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.**

H. Do not use graphite pencils to mark metal surfaces.

2.05 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. Style A in accordance with SMACNA's Architectural Sheet Metal Manual.
2. Fabricate in minimum 96-inch- (2400-mm-) 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, and gutter accessories from same metal as gutters**.**
5. Expansion Joints: Lap type.
6. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following materials:
a) Galvanized Steel: **0.022 inch (0.56 mm)** thick.
7. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following materials:
a) Galvanized Steel: **0.028 inch (0.71 mm)** thick.
8. Gutters with Girth 21 to 25 Inches (530 to 640 mm): Fabricate from the following materials:
a) Galvanized Steel: **0.034 inch (0.86 mm)** thick.
9. Gutters with Girth 26 to 30 Inches (660 to 760 mm): Fabricate from the following materials:
a) Copper: **24 oz./sq. ft. (0.82 mm thick) thick**.
b) Galvanized Steel: **0.040 inch (1.02 mm)** thick.
10. Gutters with Girth 31 to 35 Inches (790 to 890 mm): Fabricate from the following materials:
a) Galvanized Steel: **0.052 inch (1.32 mm)** thick.

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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.**
   1. Fabricated Hanger Style: **Fig. 1-35B** in accordance with SMACNA's "Architectural Sheet Metal Manual."
   2. Fabricate from the following materials:
      a) Galvanized Steel: **0.022 inch (0.56 mm)** thick.

2.06 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) **and Fascia Cap**: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates.
   1. Joint Style: Overlapped, **4 inches (100 mm)** wide.
   2. Fabricate from the following materials:
      a) Galvanized Steel: [**0.028 inch (0.71 mm)**] <**Insert dimension**> thick.

B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and **drill elongated holes for fasteners on** interior leg. Miter corners, **fasten and seal** watertight. **Shop fabricate interior and exterior corners.**
   1. Coping Profile: **Fig. 3-4A** in accordance with SMACNA's "Architectural Sheet Metal Manual."
   2. Joint Style: Standing seam joint on horizontal surface with lap edges on vertical surfaces.
   3. Fabricate from the following materials:
      a) Galvanized Steel: **0.040 inch (1.02 mm)** thick or minimum thickness to meet FM Global requirement specified..

C. Roof and Roof-to-Wall Transition, Roof-to-Roof Edge-Flashing (Gravel-Stop) Transition, Roof-to-Roof Edge-Flashing (Gravel-Stop) and Fascia-Cap Transition, and Expansion-Joint Cover: Fabricate from the following materials:
   1. Galvanized Steel: **0.034 inch (0.86 mm)** thick.

D. Base Flashing: Fabricate from the following materials:
   1. Galvanized Steel: **0.028 inch (0.71 mm)** thick.

E. Counterflashing:Fabricate from the following materials:
   1. Galvanized Steel: **0.022 inch (0.56 mm)** thick.

F. Flashing Receivers: Fabricate from the following materials:
   1. Galvanized Steel: **0.022 inch (0.56 mm)** thick.

G. Roof-Penetration Flashing: Fabricate from the following materials:
   1. Galvanized Steel: **0.028 inch (0.71 mm)** thick.

2.07 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
   1. Galvanized Steel: **0.028 inch (0.71 mm)** thick.

PART 3 - EXECUTION

3.01 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.

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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.

3.02 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[**, solder**], 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 [**solder**] [**welds**] [**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 (300 mm) o.c.
6. Space individual cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of [**uncoated-aluminum**] [**and**] [**stainless steel**] sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of **10 feet (3 m)** with no joints within 24 inches (600 mm) of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate [wood blocking or sheathing not less than **1-1/4 inches (32 mm)** for nails and not less than **3/4 inch (19 mm)** for wood screws] [substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance] <Insert size requirement>.

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.

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a) Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant.
b) Form joints to completely conceal sealant.
c) When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), 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 (4 deg C).

3.03 INSTALLATION OF ROOF-DRAINAGE SYSTEM

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 riveted 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. Anchor gutter with **gutter brackets** spaced not more than **30 inches (760 mm)** apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.
7. Install gutter with expansion joints not exceeding **50 feet (15.2 m) a**part. Install expansion-joint caps.

C. Downspouts:
1. Join sections with 1-1/2-inch (38-mm) telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.
4. Provide elbows at base of downspout to direct water away from building. Refer to Drawings.
5. Connect downspouts to underground drainage system. Refer to Drawings.

D. Splash Pans:
1. Install where downspouts discharge on **low-slope roofs**.
2. Set in **elastomeric sealant** compatible with the substrate.

E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches (100 mm) in direction of water flow.

3.04 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. Roof Edge Flashing:
1. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Inter-

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lock bottom edge of roof edge flashing with continuous cleat anchored to substrate at **staggered 3-inch (75-mm)**] centers.

2. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings:

1. 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 (400-mm)** centers.
   b) Anchor interior leg of coping with washers and screw fasteners through slotted holes at **24-inch (600-mm)** centers.
2. 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.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches (100 mm) over base flashing.
3. Lap counterflashing joints minimum of 4 inches (100 mm).

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with **elastomeric** sealant and clamp flashing to pipes that penetrate roof.

3.05 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.

B. Opening Flashings in Frame Construction: Install continuous head, sill,[**jamb,**] and similar flashings to extend [**4 inches (100 mm)**] <**Insert dimension**> beyond wall openings.

C. Reglets: Installation of reglets is specified in [Section 033000 "Cast-in-Place Concrete."] [Section 042000 "Unit Masonry."] [Section <Insert Section number> "<Insert Section title>."]

3.06 INSTALLATION OF MISCELLANEOUS FLASHING

A. Equipment Support Flashing:

1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Overhead-Piping Safety Pans:

1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
2. Pipe and install drain line to plumbing waste or drainage system.

3.07 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines

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indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.08 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

3.09 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

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SECTION 078413

FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes firestopping for the following:

1. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
4. Sealant joints in fire-resistance-rated construction.

1.02 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where the following conditions exist:

1. Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
2. Where firestop systems protect penetrating items larger than a 4 inch (100 mm) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.

D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

E. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.03 SUBMITTALS

A. Product data for each type of product specified.

1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

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B. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.

1.04 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water (2.5 Pa) is maintained at a distance of 0.78 inch (20 mm) below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water (2.5 Pa), as measured 0.78 inch (20 mm) from the face exposed to furnace fire. Provide systems complying with the following requirements:
   a Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
   b Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.

B. Installer Qualifications: Engage an experienced Installer who has completed firestopping that is similar in material, design, and extent to that indicated for Project and that has performed successfully.

C. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

D. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

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PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems.

2.02 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Ceramic-Fiber and Mastic Coating: Ceramic fibers in bulk form formulated for use with mastic coating, and ceramic fiber manufacturer's mastic coating.

B. Ceramic-Fiber Sealant: Single-component formulation of ceramic fibers and inorganic binders.

C. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.

D. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.

E. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.

G. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.

H. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.

I. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

J. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.

K. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.

L. Solvent-Release-Curing Intumescent Sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

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2. Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.

M. Available Products: Products that may be incorporated in the Work include, but are not limited to, the following:
1. Ceramic-Fiber and Mastic Coating:
   a FireMaster Bulk and FireMaster Mastic, Thermal Ceramics.
2. Ceramic-Fiber Sealant:
   a Metacaulk 525, The RectorSeal Corporation.
3. Endothermic, Latex Sealant:
   a Fyre-Shield, Tremco Inc.
4. Endothermic, Latex Compounds:
   a Flame-Safe FS500/600 Series, International Protective Coatings Corp.
   b Flame-Safe FS900/FST900 Series, International Protective Coatings Corp.
5. Intumescent Latex Sealant:
   a Metacaulk 950, The RectorSeal Corporation.
   b Fire Barrier CP 25WB Caulk, 3M Fire Protection Products.
6. Intumescent Putty:
   a Pensil 500 Intumescent Putty, General Electric Co.
   b Flame-Safe FSP1000 Putty, International Protective Coatings Corp.
   c Fire Barrier Moldable Putty, 3M Fire Protection Products.
7. Intumescent Wrap Strips:
   a Dow Corning Fire Stop Intumescent Wrap Strip 2002, Dow Corning Corp.
   b CS2420 Intumescent Wrap, Hilti Construction Chemicals, Inc.
   c Fire Barrier FS-195 Wrap/Strip, 3M Fire Protection Products.
8. Job-Mixed Vinyl Compound:
   a USG Firecode Compound, United States Gypsum Co.
9. Mortar:
   a K-2 Firestop Mortar, Bio Fireshield, Inc.
   b Novasit K-10 Firestop Mortar, Bio Fireshield, Inc.
   c KBS-Mortar Seal, International Protective Coatings Corp.
10. Pillows/Bags:
   a Firestop Pillows, Bio Fireshield, Inc.
   b KBS Sealbags, International Protective Coatings Corp.
11. Silicone Foams:
   a Dow Corning Fire Stop Foam 2001, Dow Corning Corp.
   b Pensil 200 Foam, General Electric Co.
12. Silicone Sealants:
   a Dow Corning Firestop Sealant 2000, Dow Corning Corp.
   b Dow Corning Firestop Sealant SL 2003, Dow Corning Corp.
   c Pensil 100 Firestop Sealant, General Electric Co.
   d CS240 Firestop Sealant, Hilti Construction Chemicals, Inc.
   e Metacaulk 835, The RectorSeal Corporation.
   f Metacaulk 880, The RectorSeal Corporation.
   g Fyre-Sil, Tremco Inc.
   h Fyre-Sil S/L, Tremco Inc.
13. Solvent-Release-Curing Intumescent Sealants:
   a Biostop 500 Intumescent Firestop Caulk, Bio Fireshield, Inc.
   b Fire Barrier CP 25N/S Caulk, 3M Fire Protection Products.
   c Fire Barrier CP 25S/L Caulk, 3M Fire Protection Products.

N. Firestopping insulation:

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1. Blanket firestopping, mineral fiber type; Thermafiber Safing Insulation by U.S. Gypsum or approved equal. Anchor with safing clips.

2.03 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.

B. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.
   1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:
      a 50 percent movement in both extension and compression for a total of 100 percent movement.

C. Multicomponent, Nonsag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.
   1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage change in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:
      a 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement.

D. Single-Component, Nonsag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.

E. Available Products: Products that may be incorporated in the Work include, but are not limited to, the following:
   1. Single-Component, Neutral-Curing, Silicone Sealant:
      a Dow Corning 790, Dow Corning Corp.
      b Dow Corning 795, Dow Corning Corp.
      c Silpruf, General Electric Co.
      d Ultraglaze, General Electric Co.
      e 864, Pecora Corp.
   2. Multicomponent, Nonsag, Urethane Sealant:
      a Vulkem 922, Mameco International Inc.
      b Dynflex, Pecora Corp.
      c Dynatred, Pecora Corp.
      d Dynatrol II, Pecora Corp.
      e Sikaflex 2cn NS, Sika Corp.
      f Sonolastic NP 2, Sonneborn Building Products Div., ChemRex Inc.
      g Dymeric, Tremco Inc.
   3. Single-Component, Nonsag, Urethane Sealant:
      a Isoflex 880 GB, Harry S. Peterson Co., Inc.
      b Isoflex 881, Harry S. Peterson Co., Inc.
      c Vulkem 921, Mameco International Inc.
      d Sikaflex--15LM, Sika Corp.

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2.04 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
   1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
   2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.03 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
   1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

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3.04 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.05 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they 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 firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END.

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SECTION 079200

JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Silicone joint sealants.
   2. Nonstaining silicone joint sealants.
   3. Urethane joint sealants.
   4. Immersible joint sealants.
   5. Silyl-terminated polyether joint sealants.
   6. Mildew-resistant joint sealants.
   7. Polysulfide joint sealants.
   8. Butyl joint sealants.
   9. Latex joint sealants.

B. Related Requirements:
   1. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
   2. Section 321313 "Concrete Paving" for sealing joints in walkways, and curbing.

1.03 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- (13-mm-) wide joints formed between two 6-inch- (150-mm-) 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.

1.04 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 Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

D. Field-Adhesion-Test Reports: For each sealant application tested.

E. Sample Warranties: For special warranties.

1.05 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.

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1. Testing Agency Qualifications: Qualified according to ASTM C1021 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.

1.06 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: 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 specified.

1.07 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 (5 deg C)**].
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.

1.08 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: **Two** years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: **Five** years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 SILICONE JOINT SEALANTS

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A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
    a) Tremco Sealants, Inc.
    b) Pecora Corporation, Inc.
    c) Everkem Diversified Products, Inc.
    d) Sika Corporation, Inc.
    e) Sonneborn Building Products, Inc.

2.03 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 35, T, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Uses T and NT.
    a) Tremco Sealants, Inc.
    b) Pecora Corporation, Inc.
    c) Everkem Diversified Products, Inc.
    d) Sika Corporation, Inc.
    e) Sonneborn Building Products, Inc.

B. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T and NT.
    a) Tremco Sealants, Inc.
    b) Pecora Corporation, Inc.
    c) Everkem Diversified Products, Inc.
    d) Sika Corporation, Inc.
    e) Sonneborn Building Products, Inc.

C. 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 C920, Type M, Grade P, Class 25, Uses T and NT.
    a) Tremco Sealants, Inc.
    b) Pecora Corporation, Inc.
    c) Everkem Diversified Products, Inc.
    d) Sika Corporation, Inc.
    e) Sonneborn Building Products, Inc.

2.04 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
    a) Tremco Sealants, Inc.
    b) Pecora Corporation, Inc.
    c) Everkem Diversified Products, Inc.
    d) Sika Corporation, Inc.
    e) Sonneborn Building Products, Inc.

2.05 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.
    1. Bostik, Inc,
    2. Pecora Corporation, Inc.
    3. Sonneborn Building Products, Inc.

2.06 LATEX JOINT SEALANTS

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A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF. Paintable.
   1. Acceptable Manufacturers:
      a) Tremco Sealants, Inc.
      b) Pecora Corporation, Inc.
      c) Everkem Diversified Products, Inc.
      d) Sherwin Williams Company

2.07 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) or Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.08 MISCELLANEOUS MATERIALS

A. 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.

B. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 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.

3.02 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.

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b) Masonry.
c) 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) 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.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of 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 C1193 unless otherwise indicated.

3.04 CLEANING

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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.

3.05 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.

3.06 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
   1. Refer to Section 321313 “Concrete Paving”

B. Joint-Sealant Application: Exterior joints in vertical surfaces .
   1. Joint Locations:
      a) Construction joints in cast-in-place concrete.
      b) Joints between plant-precast architectural concrete units.
      c) Control and expansion joints in unit masonry.
      d) Joints in dimension stone cladding.
      e) Joints in glass unit masonry assemblies.
      f) Joints in exterior insulation and finish systems.
      g) Joints between metal panels.
      h) Joints between different materials listed above.
      i) Perimeter joints between materials listed above and frames of doors, windows, and louvers.
      j) Control and expansion joints in ceilings and other overhead surfaces.
   2. Joint Sealant: Urethane, S, NS, 35, T, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
   1. Joint Locations:
      a) Isolation joints in cast-in-place concrete slabs.
      b) Control and expansion joints in tile flooring.
   2. Joint Sealant: Urethane, M, P, 25, T, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a) Control and expansion joints on exposed interior surfaces of exterior walls.
      b) Tile control and expansion joints.
      c) Vertical joints on exposed surfaces of unit masonry walls and partitions.
   2. Joint Sealant: M, NS, 50, T, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. 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.

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2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 100/50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

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SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:
   1. Interior standard steel doors and frames.
   2. Exterior standard steel doors and frames.
   3. Interior custom hollow-metal doors and frames.
   4. Exterior custom hollow-metal doors and frames.

B. Related Requirements:
   1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.03 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.04 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.

1.05 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. 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.

1.06 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly, fire-rated borrowed-lite assembly, and thermally rated door assem-

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blies for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

C. Field quality control reports.

1.07 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.08 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- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Steelcraft, Cincinnati, Ohio

B. Ceco, Oakbrook Terrace, Illinois

C. Curries Company, Mason City, Iowa

2.02 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 **and temperature-rise limits** 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.

2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

3. Temperature-Rise Limit: **At vertical exit enclosures and exit passageways**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than **0.40 deg Btu/F x h x sq. ft. (2.27 W/K x sq. m)** when tested according to ASTM C518.

2.03 MATERIALS

A. Doors, frames and frame components shall be manufactured from cold-rolled steel conforming to ASTM specification A366; or hot-dipped galvanized steel having an A60 zinc coating conforming to ASTM specification A525-93, A526-90,

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or A642-90. Galvanized steel shall be treated to insure proper paint adhesion. All component parts used in galvanized doors and/or frames shall meet the galvanize specification. Stainless steel shall be fabricated from type 304 or 316 stainless steel polished to a number 4 matte finish.

B. DOORS

1. Exterior doors shall be 16 gauge galvanized steel.
2. Interior doors shall be 18 cold rolled steel, 16 gauge at labeled doors.
3. Construction of Doors
   a) Doors shall be full-flush or full-flush seamless construction, fabricated from cold-rolled steel or hot-dipped galvanized steel. Doors shall be reinforced, stiffened, sound deadened and insulated with impregnated kraft honeycomb core completely filling the inside of the doors and laminated to inside faces of both panels using contact adhesive applied to both panels and honeycomb core. Door shall have continuous vertical mechanical interlocking joints at lock and hinge edges with visible edge seams or with edge seam filled and ground smooth. The internal portion of the seam shall be sealed with epoxy. An intermittent fastening along the seam is not permitted. Doors shall have beveled (1/8" in 2") hinge and lock edges. Top and bottom steel reinforcement channels shall be 14 gauge and spot welded to both panels. Hinge reinforcements shall be 8 gauge for 1-3/4" doors and 10 gauge for 1-3/8" doors. Lock reinforcements shall be 16 gauge and closer reinforcements 14 gauge box minimum 20" long. Hinge and lock reinforcements shall be projection welded to the edge of the door. Galvanized doors shall have galvanized hardware reinforcements. Adequate reinforcements shall be provided for other hardware as required.
4. All exterior swing-out doors shall have the tops closed to eliminate moisture penetration. Door tops shall not have holes or openings. Top caps are permitted.
5. All exterior doors shall include a self-adjusting, concealed door sweep installed in the bottom channel. The bottom seal shall not include springs.

C. FRAMES

1. Exterior frames shall be 14 gauge galvanized steel. The throat of exterior frames shall be 1/8” larger than exterior wall thickness. Exterior wall thickness does not include exterior veneer or metal wall panels if applicable.
2. Interior frames shall be 16 gauge cold rolled steel,14 gauge at labeled frames. The throat of interior frames shall be 1/8” larger than interior wall assembly thickness, except at interior of CMU toilet partitions.
3. Construction of Frames
   a) Flush frames shall be formed from 16 or 14 gauge cold-rolled or galvanized steel.
   b) Frames shall have 2" faces. 16 and 14 gauge frames shall be set-up and arc-welded. Miter corners shall have reinforcements with four integral tabs for secure and easy interlocking jambs to head.
   c) 16 and 14 gauge frames shall be supplied with factory installed inserted type rubber bumpers, (3) per strike jamb and (2) per head, for pair of doors. Stick on bumpers shall not be permitted.

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d) Frames for 1-3/4" doors shall have 8 gauge steel hinge reinforcements. Strike reinforcements shall be 16 gauge and prepared for an ANSI-A115.1-2 strike.

e) Metal plaster guards shall be provided for all mortised cutouts.

f) All hinge and strike reinforcements shall be projection welded to the door frame.

g) Reinforcements for surface closer shall be 14 gauge steel. Adequate reinforcements shall be provided for other hardware when required.

h) Frames shall be furnished with a minimum of six wall anchors and two adjustable base anchors of manufacturer's standard design.

2.04 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 (19 mm) 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 and Transom Bar** Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by 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.
4. Terminated Stops (Hospital Stops): Terminate stops **6 inches (152 mm)** above finish floor with a **90**-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

C. 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 ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. 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 [**beveled**] [**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.

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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 (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.05 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 ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.06 LOUVERS

A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

PART 3 - EXECUTION

3.01 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.

3.02 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.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
5. 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.**
6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

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a) Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b) Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c) Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d) Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
e) The inside of all frames shall be fully grouted.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Finish Hardware: The location of hardware shall be as follows unless otherwise shown on drawings:

E. Locate door knobs to center strikes 40-5/16" above finished floor; center door pulls 42" and push plates 48" above finished floor; center cylinder deadlocks 60" above finished floors except where push and pull plates are cut to accommodate cylinders; below head of frame; locate centerline of bottom hinge 10-3/8" above finished floor; space center hinges equal distance between top and bottom hinges. Center panic devices 38" above finished floor.

F.

G. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.03 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

C. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in **NFPA 80 and NFPA 101**.

3.04 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.

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SECTION 083313

OVERHEAD COILING COUNTER SHUTTERS

PART 1 - GENERAL

1.01 SUMMARY
- A. This Section includes overhead coiling doors for the Concession Areas.
- B. Related Sections include the following:
  1. Section 087100 "Door Hardware" for lock cylinders and keying.

1.02 DEFINITIONS
- A. Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.03 SUBMITTALS
- A. Product Data: For each type and size of overhead coiling door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
  1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Alpine Overhead Doors, Inc.
  2. Atlas Door Corp.; Div. of Clopay Building Products Co.
  3. Dynamic Closures Corp.
  4. Mahon Door Corp.
  5. Overhead Door Corporation.
  6. Raynor Garage Doors.
  7. Wayne-Dalton Corp.
  8. Windsor Door; A United Dominion Company.
  9. C.H.I. Overhead Doors.

2.02 DOOR CURTAIN MATERIALS AND CONSTRUCTION
- A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of material thickness recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
  1. Aluminum Curtain Slats: 1/2" deep, .040 aluminum, clear anodized 204 R-1 finish.
- B. Endlocks: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, either stainless-steel or aluminum extrusions to suit type of curtain slats.
  1. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene, between angles or fitted to shape, as a cushion bumper for interior door.

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D. Curtain Jamb Guides: Fabricate curtain jamb guides of angles, or channels and angles of material and finish to match curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Provide continuous integral wear strips to prevent metal-to-metal contact and minimize noise of travel and removable stops on guides to prevent overtravel of curtain.

2.03 HOODS AND ACCESSORIES

A. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weatherseal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.
   1. Hood shall be 0.04" thick aluminum, square shape.

B. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.
   1. Provide pull-down straps or pole hooks for doors more than 84 inches (2130 mm) high.

C. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
   1. Locking Bars: Full-disc Cremone type, both jamb sides, operable from inside and outside.
   2. Lock cylinder is specified in another Division 8 Section.

D. Chain Lock Keeper: Suitable for padlock.

2.04 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or 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. (2.5 mm/m) of span under full load.

C. Provide spring balance of 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. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

2.05 FINISHES, GENERAL

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" 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.

2.06 ALUMINUM FINISHES

A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

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B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

2.07 MANUAL DOOR OPERATORS

A. Provide manual operators, unless electric door operators are indicated. When not shown, provide chain-hoist operator unit.

B. Push-up Operation: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25 lbf (111 N).

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

1. Install fire-rated doors to comply with NFPA 80.

3.02 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.03 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   a. Test door closing when activated by detector or alarm connected fire-release system. Reset door-closing mechanism after successful test.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
4. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
5. Schedule training with Owner with at least 7 days' advance notice.

END.

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SECTION 083323

OVERALL COILING INSULATED SERVICE DOORS

PART 1 GENERAL

1.01 SUMMARY
1. Overhead coiling insulated doors.

1.02 REFERENCES
1. NFRC 102 - Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.
2. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
3. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.
4. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
5. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
6. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
7. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
8. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
9. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
10. NEMA MG 1 - Motors and Generators.

1.03 DESIGN / PERFORMANCE REQUIREMENTS
1. Overhead coiling service doors:
   a. Wind Loads: Design door assembly to withstand wind/suction load of 20 psf (958 Pa) without damage to door or assembly components in conformance with ASTM E 330.
   b. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.
2. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.
3. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.04 SUBMITTALS
1. Submit under provisions of Section 013300.
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. Details of construction and fabrication.
   d. Installation instructions.
3. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.
4. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

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5. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.
6. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
7. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.05 QUALITY ASSURANCE

1. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.
2. Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.
3. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   a. Finish areas designated by Architect.
   b. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   c. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE, AND HANDLING

1. Store products in manufacturer's unopened packaging until ready for installation.
2. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
3. Store materials in a dry, warm, ventilated weathertight location.

1.07 PROJECT CONDITIONS

1. 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.

1.08 COORDINATION

1. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.09 WARRANTY

1. Warranty: Manufacturer’s limited door warranty for 2 years for all parts and components. MANUAL

PART 2 PRODUCTS

MANUFACTURER

1. Acceptable Manufacturers:
   a. Overhead Door Corporation (Basis of Design)
      2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067
      Tel.: (800) 275-3290
      Web Site: www.overheaddoor.com
   b. The Cookson Company, Inc.
      1901 South Litchfield Road, Goodyear, AZ 85338
      Tel.: (800) 294-4358
      Web Site: www.cooksondoor.com
   c. C.H.I. Overhead Doors
      Arthur, IL
      Web Site: www.chiohd.com
   d. Requests for substitutions will be considered in accordance with provisions of Section 012500.

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1.02 OVERHEAD INSULATED AND NON-INSULATED COILING SERVICE DOORS

1. Insulated Service Doors: Overhead Door Corporation Model 625.
   a. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
   b. Flat profile type F-265i for doors up to 40 feet (12.19 m) wide.
   c. Front slat fabricated of:
      1) 22 gauge galvanized steel.
   d. Back slat fabricated of:
      1) 24 gauge galvanized steel.
         (a) 24 gauge stainless steel.
      2) Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.
         (a) R-Value: 7.7, U-Value: 0.13.
   e. Finish:
      1) Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
         (a) Powder coat: PowderGuard
            (1) PowderGuard Premium: Weather resistant polyester powder coat color as selected by the Architect.
            (2) PowderGuard Weathered Finish: Industrial textured powder coat provides a thicker, more scratch resistant coat. Applied to entire door system including slats, guides, bottom bar and head plate.
      2) Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
      3) Aluminum: Slats and hood shall be aluminum finished as follows.
         (a) Finish: Powder coat, PowderGuard.
            (1) PowderGuard Premium: Weather resistant polyester powder coat color as selected by the Architect.
   f. Weatherseals:
      1) Vinyl bottom seal, exterior guide and internal hood seals.
      2) Interior guide weatherseal on exterior doors only
      3) Lintel weatherseal on exterior doors only.
   g. Bottom Bar:
      1) Two prime painted steel angles minimum thickness 1/8 inch (3 mm) bolted back to back to reinforce curtain in the guides.
   h. Extruded aluminum angle minimum thickness 1/8 inch (3 mm) bolted back to back to reinforce curtain in the guides.
   i. Guides: Three Structural steel angles
      1) Finish: PowderGuard Weathered finish with iron/black powder.
   j. Brackets:
      1) Hot rolled prime painted steel to support counterbalance, curtain and hood.
   k. Counterbalance:
      1) Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
   l. Hood: Provide with internal hood baffle weatherseal.
      1) 24 gauge galvanized steel with intermediate supports as required
   m. Manual Operation:
      1) Chain operation.
   n. Windload Design:
      1) Standard windload shall be 20 PSF.
   o. Locking:

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1) Chain keeper locks for chain hoist operation.

p. Wall Mounting Condition:
   1) Face-of-wall mounting.

q. Insulated Vision Lites: Provide with uniformly spaced openings.
   1) Size: 10 inch by 1 inch (254 mm by 25.4 mm)
   2) Provide with dual wall polycarbonate lites.

PART 3 EXECUTION

1.01 EXAMINATION

1. Verify opening sizes, tolerances and conditions are acceptable.
2. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
3. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

1.02 PREPARATION

1. Clean surfaces thoroughly prior to installation.
2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

1.03 INSTALLATION

1. Install in accordance with manufacturer's instructions.
2. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
3. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
4. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
5. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.
6. Install perimeter trim and closures.
7. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

1.04 ADJUSTING

1. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
2. Adjust hardware and operating assemblies for smooth and noiseless operation.

1.05 CLEANING

1. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
2. Remove labels and visible markings.
3. Touch-up, repair or replace damaged products before Substantial Completion.

1.06 PROTECTION

1. Protect installed products until completion of project.

END OF SECTION

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SECTION 092900

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Non-load-bearing steel framing members for gypsum board assemblies.
2. Gypsum board assemblies attached to steel framing.
3. Gypsum board assemblies attached to furring members.
4. Gypsum board bonded adhesively to interior concrete and masonry substrates.

1.02 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11-15 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

1.03 ASSEMBLY PERFORMANCE REQUIREMENTS

A. Sound Transmission Characteristics: For gypsum board assemblies indicated to have STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined per ASTM E 90-09 and classified per ASTM E 413-10 by a qualified independent testing agency.

1.04 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

1. Product data for each type of product specified.
2. Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.
3. 24”x24” physical sample of interior GWB with textured surfacing. The texture must be approved by the Owner/Architect prior to proceeding with installation on the project.

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119-14 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire Resistance Ratings: As indicated by reference to design designations in UL "Fire Resistance Directory".
2. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer.
3. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.
4. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against

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damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.07 PROJECT CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840-13 and with gypsum board manufacturer's recommendations.

B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 degrees F (4 degrees C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 degrees F (10 degrees C) for 48 hours prior to application and continuously after until dry. Do not exceed 95 degrees F (35 degrees C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 PRODUCTS

2.01 MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Steel Framing and Furring:
1. Dale Industries, Inc., www.clarksteel.com
2. Clark Dietrich Building Systems, www.clarkdietrich.com
3. Gold Bond Building Products Div., National Gypsum Co., www.nationalgypsum.com
4. Worthington Industries, www.worthingtonindustries.com
5. Marino/Ware Cold Formed Steel Framing Systems, www.marinoware.com
6. Steel Stud Manufacturers Association (SSMA), www.ssma.com
7. Certified Steel Stud Association, www.certifiedsteelstud.com
8. Steelfast Framing Systems, Inc.

B. Grid Suspension Assemblies:
1. Rockfon (North America), www.rockfon.com
2. Worthington Armstrong Venture WAVE,www.armstrong.com
3. USG Interiors, Inc., www.usg.com

C. Gypsum Board and Related Products:
1. Certain Teed, www.certainteed.com/gypsum
2. Georgia-Pacific Pacific Building Products-Georgia Pacific Gypsum, www.buildgp.com
3. Continental Building Products, Inc., www.continental-bp.com
4. Gold Bond Building Products Div., National Gypsum Co., www.nationalgypsum.com
5. United States Gypsum Co., www.usg.com

2.02 STEEL FRAMING COMPONENTS FOR SUSPENDED & FURRED CEILINGS

A. General: Provide components of sizes indicated but not less than that required to comply with ASTM C 754-15 for conditions indicated. Do not substitute “equivalent” thickness or coatings for the thickness or finish specified.

B. Powder-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

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ceiling construction, as determined by testing per ASTM E 1190-11 conducted by a qualified testing agency.

C. Wire for Hangers and Ties: ASTM A 641/A 641M-15, Class 1 zinc coating, soft temper.

D. Hanger Rods: Mild steel and zinc-coated or protected with rust-inhibitive paint.

E. Flat Hangers: Mild steel and zinc-coated or protected with rust-inhibitive paint.

F. Channels: Cold-rolled steel, 0.05980 inch minimum thickness of base (uncoated) metal and 7/16 inch wide flanges, and as follows:
   1. Carrying Channels: 1-1/2 inch deep, 475 lb per 1000 feet, unless otherwise indicated.
   2. Finish: Rust-inhibitive paint, unless otherwise indicated.
   3. Finish: G 60 hot-dip galvanized coating per ASTM A653/A 653M-15 for framing for exterior soffits.

G. Steel Studs for Furring Channels: ASTM C 645-14, with flange edges bent back 90E and doubled over to form 3/16 inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:
   1. Thickness: –0.0269 inch, unless otherwise indicated.
   2. Depth: 3-5/8 inch, unless otherwise indicated.
   3. Protective Coating: G 40 hot-dip galvanized coating per ASTM A 653/A 653M-15 for framing for exterior soffits and ceiling suspension members in areas within 10' of exterior walls

H. Steel Rigid Furring Channels: ASTM C 645-14, hat-shaped, depth of 7/8 inch, and minimum thickness of base (uncoated) metal as follows:
   1. Thickness: 0.0179 inch, unless otherwise indicated.
   2. Protective Coating: Manufacturer's standard corrosion-resistant coating.

I. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, fabricated from steel sheet complying with ASTM A 653/A 653M-15 or ASTM A 568-14 to form 1/2 inch deep channel of the following configuration:
   1. Single-Leg Configuration: Asymmetric-shaped channel with face connected to a single flange by a single slotted leg (web).
   2. Double-Leg Configuration: Hat-shaped channel, with 1-1/2 inch wide face connected to flanges by double slotted or expanded metal legs (webs).
   3. Configuration: Either configuration indicated above.

J. Grid Suspension System for Interior Ceilings: ASTM C 645-14, manufacturer's standard direct-hung grid suspension system composed of main beams and cross furring members that interlock to form a modular supporting network. See specification section 09510.

2.03 STEEL FRAMING FOR WALLS AND PARTITIONS

A. General: Provide steel framing members complying with the following requirements:
   1. Component Sizes and Spacings: As indicated but not less than that required to comply with ASTM C 754-15 under the following maximum deflection and lateral loading conditions:
      a . Maximum Deflection: L/240 at 5 lbf per SF.
   2. Protective Coating: Manufacturers standard corrosion-resistant coating.
   3. Do not substitute “equivalent” thickness or coatings for the thickness or finish specified.

B. Steel Studs and Runners: ASTM C 645-14, with flange edges of studs bent back 90E and doubled over to form 3/16 inch wide minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth.
   1. Thickness:
      a . Interior Walls- 0.0269 inch

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b . Exterior Walls and Interior Walls serving as back-up for masonry- 0.0428 inch.

2. Depth: 6 inch typical, unless otherwise noted on drawings.

C. Steel Rigid Furring Channels: ASTM C 645-14, hat-shaped and Z shaped, depth and minimum thickness of base (uncoated) metal as follows:
1. Depth: 7/8 inch and 2".
2. Thickness: 0.0179 inch, unless otherwise indicated and per metal wall panel manufacturer's requirements.

D. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, fabricated from steel sheet complying with ASTM A 653/A 653M-15 or ASTM A 568-14 to form 1/2 inch deep channel of the following configuration:
1. Single-Leg Configuration: Asymmetric-shaped channel with face connected to a single flange by a single slotted leg (web).
2. Double-Leg Configuration: Hat-shaped channel, with 1-1/2 inch wide face connected to flanges by double-slotted or expanded metal legs (webs).
3. Configuration: Either configuration indicated above.

E. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.04 GYPSUM BOARD PRODUCTS

A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.
Thickness: Provide gypsum board in thicknesses indicated or, if not otherwise indicated, in 5/8 inch thicknesses to comply with ASTM C 840-13 for application system support spacing indicated.

B. Gypsum Wallboard: ASTM C 1396/C 1396M-14 and as follows:
1. Type: Regular for vertical surfaces, unless otherwise indicated.
2. Type: Type X where required for fire-resistive-rated assemblies.
3. Type: Sag-resistant type for ceiling surfaces.
4. Edges: Tapered and featured (rounded or beveled) for prefilling.
5. Thickness: 5/8"

C. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396-14 and as follows:
1. Type: Regular, unless otherwise indicated.
2. Thickness: 5/8 inch, unless otherwise indicated.
3. Install water resistant board at wall surfaces in all toilets.

2.05 TRIM ACCESSORIES

A. TRIM ACCESSORIES

B. Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C 1047-14 and requirements indicated below:
1. Material: Formed metal, plastic, or metal combined with paper, with the following requirement:
a Sheet Steel zinc-coated by hot-dip process.
2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047-14:
a Cornerbead on outside corners, unless otherwise indicated.
b L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
c One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.

C. Zinc Accessories for Exterior Ceilings: Corner beads, edge trim, and control

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joints formed from rolled zinc complying with ASTM C 1047-14, in shapes indicated below by reference to ASTM C 1047-14:

1. Corner Bead on outside corners, unless otherwise indicated.
2. Edge trim complying with ASTM C 1047-14, formed from rolled zinc, shape LC-Bead per Fig. 1, unless otherwise indicated.

2.06 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C 475/C475M-15 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated on the drawings.

C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

1. Where setting-type joint compounds are used as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.
3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.
4. For topping compound, use sandable formulation.

D. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.

1. Ready-Mixed Formulation: Factory-mixed product.
2. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
3. Topping compound formulated for fill (second) and finish (third) coats.
4. All-purpose compound formulated for both taping and topping compounds.

2.07 ACOUSTICAL SEALANT

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834-14 and the following requirements:

1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90-09.
2. Product has flame-spread and smoke-developed ratings of less than 25 per ASTM E 84-15.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

C. Available Products: Subject to compliance with requirements, acoustical sealants that may be incorporated in the Work include, but are not limited to the following:

1. Acoustical Sealant:
   a AC-20 FTR Acoustical and Insulation Sealant, Pecora Corp.
   b SHEETROCK Acoustical Sealant, United States Gypsum Co.
   c Dow Corning, Inc.
2. Acoustical Sealant for Concealed Joints:
   a BA-98, Pecora Corp.
   b Tremco Acoustical Sealant, Tremco, Inc.

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c Dow Corning, Inc.

2.08 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

B. Spot Grout: ASTM C 475/C 475M-15, setting-type joint compound recommended for spot grouting hollow metal door frames.

C. Steel drill screws complying with ASTM C 1002-14 for the following applications:
   1. Fastening gypsum board to steel members less than 0.03 inch thick.
   2. Fastening gypsum board to gypsum board.

D. Steel drill screws complying with ASTM C 954-15 for fastening gypsum board to steel members from 0.033 inch to 0.112 inch thick.

E. Corrosion-resistant-coated steel drill screws of size and type recommended by board manufacturer for fastening cementitious backer units.

F. Sound Attenuation Blankets: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665-12 for Type I (blankets without membrane facing):
   1. Mineral-Fiber Type: Fibers manufactured from glass or slag.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, case-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

3.03 INSTALLING STEEL FRAMING, GENERAL

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754-15 and with ASTM C 840-13 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co., 7th Edition (2014).

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
   1. Where building structure abuts ceiling perimeter or penetrates ceiling.
   2. Where partition framing and wall furring abut structure except at floor.

D. Do not bridge building expansion and control joints with steel framing or furring members as indicated.

3.04 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

A. Suspend ceiling hangers from building structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other

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objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing and counter-splaying.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspensions members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, screweyes, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. Secure flat, angel, channel, and rod hangers to structure, including intermediate framing members by attaching to inserts, screweyes, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
5. Do not attach hangers to steel roof deck. Attach hangers to structural members.
6. Do not connect or suspend steel framing from ducts, pipers or conduit.

B. Sway-brach suspended steel framing with hangers used for support.

C. Install suspended steel framing components in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard.
1. Wire Hangers: 0.1620 inch (8 gauge) diameter, 4 feet on center.
2. Carrying Channels (Main Runners): 1-1/2 inch, 4 feet on center.
3. Rigid Furring Channels (Furring Members): 24 inch on center.

D. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring members or grid suspension members are level to within 1/8 inch in 12 feet measured both lengthwise on each member and transversely between parallel members.

E. Wire-tie or clip furring members to main runners and to other structural supports as indicated on the drawings.

F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. For exterior soffits, install cross-bracing and additional framing to resist wind uplift according to details on Drawings

H. .

3.05 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Cut studs 1/2 inch short of full height. Continue framing over

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frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

D. Terminate partition framing at suspended ceilings where indicated.

E. Install steel studs and furring in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard to comply with maximum deflection and minimum, loading requirements specified.
   1. Single and Double Layer Construction: Space studs at 24 inch on center.

F. Install steel studs so that flanges point in the same direction and so that leading edges or ends of each gypsum board can be attached to open (unsupported) edges of stud flanges first.

G. Frame door openings to comply with details indicated, with GA-219, and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs. Extend vertical jamb through suspended ceilings and attach to underside of floor or roof structure above.

H. Frame openings other than door openings to comply with details indicated or, if none indicated, in same manner as required for door openings. Install framing below sills of openings to match framing required above door heads.

3.06 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840-13 and GA-216.

B. Install sound attenuation blankets where indicated prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install wall/partition board panels to minimize the number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one framing member in alternate courses of board. At stairwells and other high walls, install panels horizontally with end abutting joints over studs and staggered.

E. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. 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.

F. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges and ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions. Avoid joints at corners of framed openings where possible.

G. Attach gypsum panels to steel studs so that the leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. Attach gypsum panels to framing provided at openings and cutouts.

I. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors, and doors over 32 inches wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.

J. Form control joints and expansion joints at locations indicated and as detailed on the drawings, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
   1. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.) except in chase walls that are braced internally.

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a Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 SF in area.
b Fit gypsum panels around ducts, pipes, and conduits.
c Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4 inch to 1/2 inch wide joints to install sealant.

K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4 inch to 1/2 inch wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

L. Where STC-rated gypsum board assemblies are indicated, seal construction at perimeters, behind control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of the partitions. Comply with ASTM C 919-12 and manufacturer's recommendations for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

M. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.07 GYPSUM BOARD APPLICATION METHODS

A. Single Layer Application: Install gypsum wallboard panels as follows:
1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated on the drawings.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.

B. Wall Tile Substrates: For substrates indicated to receive thin-set ceramic tile and similar rigid applied wall finishes, comply with the following:
1. Install water-resistant gypsum backing board panels at showers, tubs, and where indicated. Install gypsum wallboard panels with tapered edges taped and finished to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

C. Double-Layer Application: Install gypsum backing board for base layers and gypsum wallboard for face layers.
1. On ceilings, apply base layer prior to applying base layer on walls/partitions; apply face layers in same sequence. Offset face-layer joints at least 10 inch from parallel base-layer joints. Apply base layers at right angles to framing members unless otherwise indicated on the drawings.
2. On partitions/walls, apply base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face layer joints offset at least one stud or furring member with base layer joints. Stagger joints on opposite sides of partitions.

D. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:
1. Fasten with screws.

E. Double-Layer Fastening Methods: Apply base layer of gypsum panels and face layer to base layer as follows:
1. Fasten both base layers and face layers separately to supports with screws.

F. Exterior Soffits and Ceilings: Apply exterior gypsum soffit board panels perpendicular to supports, with end joints staggered over supports. Install with

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1/4 inch open space where panels abut other construction or structural penetrations.

1. Fasten with corrosion-resistant screws.

3.08 INSTALLING TRIM ACCESSORIES

A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

B. Install corner beads at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.

1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
2. Install L-bead where edge trims can only be installed after gypsum panels are installed.

D. Install control joints at locations indicated, and where not indicated according to ASTM C 840-13, and in locations approved by Architect for visual effect.

3.09 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, flanges of corner beads, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere to prepare gypsum board surfaces for decoration.

B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints except those with accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.

D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.

1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated and sound-rated assemblies.
2. Level 2 where water-resistant gypsum backing board panels form substrates for tile, and where indicated.
3. Level 3 for gypsum board surfaces for surfaces receiving medium or heavy textured finishes before painting.
4. Level 4 for gypsum board surfaces for surfaces receiving light-textured finishes, wallcoverings, and flat paints over light textures.
5. Level 5 for gypsum board surfaces receiving gloss and semi-gloss enamels and non-textured flat paints.
6. Provide textured finish on all wall surfaces exposed to view by building occupants. Texture shall be approved by Owner/Architect prior to installation. Textured finish is to be installed on walls only and not soffits and ceilings.

E. For Level 4 gypsum board finish, embed tape in joint compound and apply three separate coats of joint compound over joints, angles fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration. Use one of the following joint compound combinations:

1. Embedding and First Coat: Setting-type joint compound. Fill (Second) Coat: Setting-type joint compound. Finish (Third) Coat: Sandable, setting-type joint compound.

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2. Embedding and First Coat: Setting-type joint compound. Fill (Second) Coat: Setting-type joint compound. Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
3. Embedding and First Coat: Ready-mixed, drying-type, all purpose or taping compound. Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound. Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
4. Embedding and First Coat: Job-mixed, drying-type taping compound. Fill (Second) Coat: Job-mixed, drying-type topping compound. Finish (Third) Coat: Job-mixed, drying-type topping compound.
5. Embedding and First Coat: Job-mixed, drying-type, all-purpose compound. Fill (Second) Coat: Job-mixed, drying-type, all-purpose compound. Finish (Third) Coat: Job-mixed, drying-type, all-purpose compound.
6. Embedding and First Coat: Setting-type compound. Fill (Second) Coat: Setting-type compound. Finish (Third) Coat: Job-mixed, drying-type, all-purpose compound.

F. Where Level 3 gypsum board finish is indicated, apply joint compounds specified for first and second coat in addition to embedding coat.

G. Where Level 2 gypsum board finish is indicated, apply joint specified for first coat in addition to embedding coat.

H. Where Level 1 gypsum board finish is indicated, apply joint compound specified for embedding coat.

I. Finish water-resistant gypsum backing board forming base for ceramic tile to comply with ASTM C 840-13 and board manufacturer's directions for treatment of joints behind tile.

3.10 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner suitable to Installer that ensures gypsum board assemblies remain without damage or deterioration at time of Final Inspection.

END.

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SECTION 096700

QUARTZ FLOORING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fluid applied seamless flooring with integral cove base.
2. Joint, edge, and termination strips.
3. Prior to installation of structural floor slab, advise General Contractor, in writing, of all requirements of concrete substrate regarding finish, level tolerance, and curing.
4. Locate all flexible joints required. See submittals below.
5. Accessories necessary for complete installation.

B. Related Sections:

1. Cast-in-Place Concrete: Section 033000.
   a) Concrete sub-floor to be level (maximum variation not to exceed ¼ inch in 10 feet) and to have a steel troweled finish. No curing agents or other additives which could prevent bonding should be used unless the mechanical surface preparation method completely removes the curing agent residue or sealer.
   b) Slabs on grade must have an efficient puncture resistant vapor barrier placed directly under the slab.
2. Sealants: Section 079200.
3. Gypsum Drywall: Section 092900.
4. Adjacent floor finishes: Division 9.

1.02 REFERENCE STANDARDS

The publications listed below from a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. American Society for Testing and Materials (ASTM) Publications:

1. C-307 Test Method for Tensile Strength of Chemical-Resistant Mortars.
2. C-501 Test Method for Relative Resistance to Wear Unglazed Ceramic Tile by the Taber Abraser.
3. C-531 Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing.
4. C-579 Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfaces.
5. C-580 Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing.
6. C-884 Test Method for Thermal Compatibility Between Concrete and an Epoxy Resin Overlay.
7. D-570 Water Absorption of Plastics.
8. D-695 Compression Properties of Rigid Plastic.

B. Military Specifications (Mil. Spec.)

1. MIL D-3 134 F (Impact Resistance) Section 4.7.3.
2. MIL D-3 134 F (Indentation Resistance) Section 4.7.4.
3. MIL D-3234 F (Resistance to Elevated Temperature) Section 4.7.5.

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C. ACI 301 Specifications for Structural Concrete for Buildings (most recent edition). Committee in Concrete 403 bulletin 59-43, Bond Strength to Concrete.

1.03 DEFINITIONS

A. Epoxy Resin Flooring specified under this section is referenced on the drawings as Epoxy Flooring.

1.04 SYSTEM DESCRIPTION

A. System shall be 1/8 inch moisture vapor tolerant epoxy surfacing with broadcast colored quartz aggregate to form a decorative surface. Surface finish shall be a two component UV light resistant epoxy grout and water based aliphatic urethane sealer.

1.05 SUBMITTALS

A. Samples: Submit 6 by 6 inch cured samples of flooring system indicating color combination and non-skid properties. Approved samples will be used during installation for product match.

B. Certified Test: Submit two copies of suppliers/ manufacturers written certification that flooring system meets or exceeds required properties.

C. Manufacturers Application Instructions: Submit descriptive data and specific recommendations for mixing, application, curing including any precautions of special handling instructions required to comply with the Occupational Safety and Health Act.

D. Shop Drawings: Shop Drawings shall be furnished showing installation of cove base and termination details, and details at floor material transitions and where adjoining equipment.

1. Locate and provide detailing for flexible joints required for flooring in area of installation.

E. Maintenance Instructions: Submit current copies of the flooring manufacturer's printed recommendations on maintenance methods and products. Submit in accordance with Section 017823 - Operation and Maintenance Manuals.

1.06 QUALITY ASSURANCE

A. Materials used in the floor surfacing shall be the products of a single manufacturer.

B. Installation shall be performed by an applicator with minimum 5 years experience in work of similar nature and scope. Installer must be approved by the manufacturer of the floor surfacing materials. The contractor shall furnish a written statement from the manufacturer that the installer is acceptable.

C. Installer to verify locations of all flexible joints required by the provisions of this Section and by the recommendations of the related material manufacturers.

1. Joint locations may or may not be shown in drawings.
2. Refer to drawings required under SUBMITTALS above.

D. Installer to keep daily log of the date of installation, room number, type, color, and method of application of product being installed. Log must be available for inspection by the Architect upon request.

E. Contractor to have proven experience with specified system.

F. Portable mock-up: Prior to starting application of flooring, provide full scale portable mock-up to establish acceptable quality, durability, and appearance. Mock-up size must not be less than 4 square feet.

1. Acceptable mock-up to be standard of quality for installed work.

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2. Unacceptable installed work to be removed and replaced until acceptable. Aesthetically unacceptable but well bonded work may be overlaid or recoated per Manufacturer's instructions if thickness clearances permit.

G. Qualifications:
1. Installer: Must be acceptable to Architect, and Manufacturer.

1.07 PROJECT CONDITIONS

A. Maintain the ambient room and the floor temperatures at 60 degrees Fahrenheit, or above, for a period extending from 72 hours before, during and after floor installation. Concrete to receive surfacing shall have cured for at least 5 days.

B. Dew Point: Substrate temperature must be minimum of 5 degrees above dew point prior to, during or up to 24 hours after application of flooring system.

C. Illumination: Apply flooring system only where a minimum of 30 footcandles exist when measured 3 feet from surface.

D. Advise other trades of fixtures and fittings not to be installed until flooring is cured and protected.

1.08 PROTECTION

A. Protect adjacent surfaces not scheduled to receive the flooring by masking, or by other means, to maintain these surfaces free of the flooring material.

B. Provide adequate ventilation and fire protection at all mixing and placing operations. Prohibit smoking or use of spark or flame producing devices within 50 feet of any mixing or placing operation.

C. Provide polyethylene or rubber gloves or protective creams for all workmen engaged in applying products containing epoxy.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to project site in original manufacturer's sealed containers including type of material, batch numbers, date of manufacture, and pertinent labels intact and legible.

B. Store materials in dry protected area at a temperature between 60° F to 80° F.

C. Follow all manufacturer's specific instructions and prudent safety practices for storage and handling.

1.10 WARRANTY

A. Contractor to guarantee work under this Section to be free from defects of material and installation for the duration of the warranty period. Defects occurring during warranty period shall be repaired, in a manner satisfactory to the Owner and the Architect, at no additional cost to the Owner.
1. Warranty Period: One (1) Year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Specifications and quality of design standard (basis of design) based on Key Resin Company: Key Epocon Quartz.
Key Resin Company: 888-943-4532, www.keyresin.com

B. Acceptable Manufacturers:
1. Key Resin Company

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2. Plexi-Chemie Inc., Jacksonville, FL
3. Micor Co., Inc.
4. Florock, Inc. – www.florock.net

C. System description: Moisture vapor tolerant, two-component epoxy resin surfacing broadcast with colored quartz aggregate and sealed with clear epoxy and clear urethane.

D. Alternative manufacturers must have as a minimum the standards set forth in this specification and must be preapproved in accordance with project requirements.

2.02 MATERIALS

A. Prime Coat: Key Epocon scratch coat.

B. Matrix: Key Epocon, moisture vapor tolerant epoxy resin composition.

C. Grout and Topcoats:

1. Two component UV light resistant epoxy grout, Key #512.
2. Two component water based urethane sealer, Key #445.

2.03 MIXING

A. Apply flooring to specified physical properties.

B. Provide decorative finish matching approved sample. Sample to be approved by Owner and Architect.

2.04 FINISHES

A. Color as selected by Architect or Owner from the manufacturer's standard colors.

PART 3 EXECUTION

3.01 PREPARATION

A. Obtain Architect's approval of mock-up before installing flooring.

B. Preparation of Surface:

1. Inspect surfaces to receive flooring and verify that condition is smooth and free from conditions that will adversely affect execution, permanence, or quality of work.
   a) Remove all projections, all debris detrimental to flooring system, and dirt, oil contaminates, grease, and surface coatings affecting bond.
2. Notify Architect or Owner in writing prior to commencing work of any conditions deemed unsatisfactory for the installation; installation of flooring materials is understood as acceptance of the substrate as satisfactory.
3. Concrete: The General Contractor shall be responsible for hiring an independent testing service to test for moisture content and moisture vapor emission rate; install no flooring over concrete until the concrete has been cured and is sufficiently dry to achieve permanence with flooring as determined by material manufacturer's recommended bond and moisture tests.
   a) Effectively remove concrete laitance by steel shot blasting or other method approved by flooring manufacturer.
   b) Concrete slab shall have an efficient puncture-resistant moisture vapor barrier 10 mils thick minimum placed directly under the concrete slab (for slab on grade). Testing must be done to verify that the moisture vapor emission rate of the slab does not exceed that as

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recommended by the manufacturer at time of installation of the flooring or at any future date. Moisture vapor emission and moisture content testing must conform with the requirements of ASTM F-1869-98 (Calcium Chloride Test) and ASTM F-2170-02 (Relative Humidity Probe Test). If test results show excessive levels of moisture content or vapor emission rate, apply Key Epocon at manufacturer's recommended thickness.

c) Treat cracks in concrete using manufacturer's recommended practice. Rout out crack and fill with rigid epoxy; Reinforce crack with fiberglass cloth.

3.02 INSTALLATION

A. Install all floor materials in strict conformance with manufacturer's instructions.

B. Route out all cracks (larger than hairline width) and fill with Key Crack Filler, Key Epocon or other material approved by Manufacturer of floor materials. Reinforce crack with fiberglass cloth using Key #502 Primer or the epoxy used to fill the crack.

C. Prime entire surface with Key Epocon as a scratch coat. Allow to cure.

D. Apply Key Epocon and broadcast colored quartz aggregate to excess to achieve a minimum thickness of 1/8 inch. Allow to cure a minimum of 48 hours before sweeping and vacuuming excess aggregate and proceeding with installation.

E. Apply UV light resistant epoxy grout Key #512 and allow to cure. Apply water based urethane sealer Key #445 and allow to cure. Top coats shall provide a uniform, dense surface.

F. Match finished work to approved sample, uniform in thickness, sheen, color, pattern and texture, and free from defects detrimental to appearance.

G. Integral Cove Base: Where scheduled, provide integral cove base formed from flooring over tile backerboard as specified under 092900 - Gypsum Drywall. Provide cove cap strip at top of base as recommended by flooring manufacturer and trowel material up wall to form smooth, integral transition and base 4 inches high unless otherwise indicated or scheduled.

H. Apply temporary protection until floor is fully cured. The General Contractor shall protect the finished floor from the time that the sub-contractor completes the work.

END

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SECTION 099120

PAINTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes surface preparation and field painting of the following:
   1. Exposed exterior items and surfaces.
   2. Exposed interior items and surfaces.
   3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include the following factory-finished components:
      a Architectural woodwork and casework.
      b Acoustical wall panels.
      c Metal toilet enclosures.
      d Metal lockers.
      e Finished mechanical and electrical equipment.
      f Light fixtures.
      g Distribution cabinets.
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a Foundation spaces.
      b Furred areas.
      c Ceiling plenums.
      d Pipe spaces.
      e Duct shafts.
   3. Finished metal surfaces include the following:
      a Anodized aluminum.
      b Stainless steel.
      c Chromium plate.
      d Copper.
      e Bronze and brass.
   4. Operating parts include moving parts of operating equipment and the following:
      a Valve and damper operators.
      b Linkages.
      c Sensing devices.
      d Motor and fan shafts.
   5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.02 DEFINITIONS

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A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
   3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
   4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
   5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.03 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.
   1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
   3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Samples for Confirmation: Manufacturer's color samples showing the colors specified for each type of finish-coat material indicated. When matching an Index Color, submit chips of both colors for comparison and approval.

C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
   1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
   2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

D. Qualification Data: For firms and persons specified in the "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.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Color Approval:
   Final approval of colors will be from job-applied samples.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.

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5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.06 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.

B. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:
1. Benjamin Moore (BM)
2. PPG Paints (PPG)
3. Sherwin Williams Co. (SW)

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Match colors indicated by reference to manufacturer's color designations.

PART 3 EXECUTION

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3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
   1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation, Interior or Exterior Surfaces: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.
   2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
      a Use abrasive blast-cleaning methods if recommended by paint manufacturer.
      b Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
      c Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
   3. Gypsum Drywall: Surfaces shall be clean, dry, free from all dirt, dust and foreign matter. Mud joints should be sanded smooth without raising a significant amount of paper nap in adjacent areas. Drywall joint compound should be thoroughly dry before painting. Room should be swept or vacuumed clean before painting begins. Use exterior grade patching compounds for exterior surfaces.

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4. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    a Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    b Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
    c Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
    d Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
5. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
    a Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
6. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
7. Non-Ferrous Metals: These metals react or corrode when exposed to normal weathering conditions and form a surface oxide layer. This layer poses a potential adhesion problem for paints and must be removed. ALUMINUM-Solvent clean (SSPC-SP1) to remove any oils or grease. Acid etch with Porter Metal prep #79 or Alumiprep #33 to provide an etch on the surface, or Brush Off Blast Clean (SSPC-SP 7) the surface. COPPER-Solvent Clean (SSPC-SP 1) to remove any oils and grease and lightly sand to remove any oxides.
8. Previously Painted Surfaces: Paint only clean, dry surfaces. Remove all surface contaminants to include mold, mildew, dirt, dust, oil, grease, mill scale, wax, chalk or oxidation, efflorescence, rust, mortar, and any other foreign matter existing on the surface to insure good adhesion to the existing paint. Scrape or use appropriate means to remove all loose and peeling or flaking paint from the surface. Feather sand edges if necessary. Glossy surface shall be dulled by sanding. Remove all sanding dust from the surface after sanding has taken place. Prepare bare areas as new surfaces, and spot prime any bare areas with appropriate primer or filler. Patch or repair any cracks or voids with the appropriate patching compound and sand smooth as necessary. Spot prime any patched areas prior to finishing. If after cleaning chalky exterior surfaces chalk residue is still present, prime the entire surface with the proper bonding primer to insure good adhesion to the substrate.
9. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
10. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
11. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material.

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If necessary, remove surface film and strain material before using.

12. Use only thinners approved by paint manufacturer and only within recommended limits.

D. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touch up painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as

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recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.
2. Heat exchangers.
3. Tanks.
4. Ductwork.
5. Insulation.
6. Accessory items.

G. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
2. Switchgear.
3. Panelboards.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
2. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and

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other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.07 PAINT SCHEDULES - EXTERIOR AND INTERIOR - All products are to be applied according to manufacturer's recommended spread rate and DFT.

A. Exterior Ferrous Metal: Provide the following painted finish over new, exterior ferrous metal:

1. Alkyd Gloss Enamel Finish: 2 finish coats of alkyd gloss enamel over an alkyd metal primer.

a Primer:
BM: Super Spec HP Alkyd Metal Primer P06 Series
PPG: 6-212 Speedhide Alkyd Metal Primer
SW: B50Z Kem Kromik Metal Primer

b Second and Third Coats:
BM: Impervo Alkyd High Gloss Enamel 133
PPG: 6-284 Speedhide Alkyd Gloss Enamel
SW: B54Z Industrial Alkyd Gloss Enamel

B. Interior Concrete Masonry Units (CMU): Provide the following painted finish over new interior CMU. All CMU walls unless noted otherwise shall be Epoxy:

1. Waterborne Gloss Polyamide Epoxy Finish: 2 finish coats of gloss waterborne polyamide epoxy over a heavy duty 100% acrylic block filler.

a Block Filler for **Normal Areas** (to be applied pin hole free):
BM: Moorcraft Int./Ext. Block Filler 173
PPG: ~~16-90 PittGlaze Int/Ext Acrylic Block Filler~~
PPG: 6-15XI Speedhide Block Filler
SW: B42W46 Acrylic Heavy Duty Block Filler

b Block Filler for **Wet Areas** (to be applied pin hole free):
SW: Kem Cati-Coat HS Epoxy Filler/Sealer
PPG: 95-217 Cementitious Epoxy Ester Block Filler

c Second and Third Coats:
BM: Super Spec HP WB Polyamide Epoxy Gloss, P42
PPG: ~~98-1 Aquapon WB Polyamide G Epoxy~~
PPG: 98E-1 Aquapon WB EP Polyamide G Epoxy
SW: B73 Waterbased Tile Clad G Epoxy @ 4.0 mils dft/ct

C. Interior Gypsum Drywall: Provide the following painted finish over new interior gypsum drywall where a latex semigloss finish is required: **(Ceilings Only)**

1. Latex Semi-Gloss Enamel Finish: 2 finish coats of latex semi-gloss enamel over a latex drywall primer.

a Primer:
BM: Super Spec Interior Latex Primer 253
PPG: 6-2 Speedhide Latex Primer Sealer
SW: B28W200 PrepRite 200 Latex Primer

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b Second and Third Coats:
BM: Super Spec Interior Latex Semi-Gloss 276
PPG: 6-500 Speedhide Latex Semi-Gloss Enamel
SW: B31W200 ProMar 200 Latex SG Enamel

D. Interior Gypsum Drywall: Provide the following painted finish over new interior gypsum drywall where an Epoxy finish is noted: **(Walls Only)**

1. Waterborne Gloss Polyamide Epoxy Finish: 2 finish coats of gloss waterborne polyamide epoxy over a latex drywall primer sealer.

a Primer:
BM: Moore's Fresh Start Interior Exterior Acrylic Primer 023
PPG: 17-921XI Seal Grip Acrylic Universal Primer
SW: B28W200 PrepRite 200 Latex Primer

b Second and Third Coats:
BM: Super Spec HP WB Polyamide Epoxy Gloss, P42
PPG: ~~98-1 Aquapon WB Polyamide G Epoxy~~
PPG: 98E-1 Aquapon WB EP Polyamide G Epoxy
SW: B73 Water Based Tile Clad G Epoxy

E. Interior Ferrous Metal: Provide the following painted finish over new interior hollow ferrous metal:

1. Alkyd Semi-Gloss Enamel Finish: 2 finish coats of alkyd semi-gloss enamel over an alkyd metal primer.

a Primer:
BM: Super Spec HP Alkyd Metal Primer P06 Series
PPG: 6-212 Speedhide Alkyd Metal Primer
SW: B50Z Kem Kromik Metal Primer

b Second and Third Coats:
BM: SuperSpec Alkyd Semi Gloss Enamel C271
PPG: 6-1110XI Speedhide Alkyd SemiGloss Enamel
SW: B34W200 ProMar 200 Alkyd SG Enamel

F. Interior and Exterior Ferrous Metal: Provide the following painted finish over interior and exterior ferrous metal where a high performance coating is required (HANDRAILS):

1. Aliphatic Urethane Enamel Finish: 2 coats of aliphatic gloss urethane finish over epoxy metal primer.

a Primer:
BM: Super Spec HP Epoxy Mastic Coating, P45
PPG: 95-245 Pitt Guard DTR Rapid Coat Mastic Epoxy
SW: B67 Series Recoatable Epoxy Primer

b Second and Third Coats:
BM: Corotech Aliphatic Acrylic Urethane Semi-Gloss, V510
PPG: 95-812 Pitt-Thane Gloss Aliphatic Urethane
SW: B65-300 High Solids Polyurethane Enamel

G. Interior Galvanized Metal: Provide the following painted finish over interior new galvanized metal:

1. Alkyd Semi-Gloss Enamel Finish: 2 finish coats of alkyd semi-gloss enamel over a galvanized metal primer.

a Primer:
BM: Super Spec HP Acrylic Metal Primer P04
PPG: 90-712 Pitt Tech DTM Acrylic Metal Primer
SW: B50W3 Galvite Galvanized Metal Primer

b Second and Third Coats:
BM: SuperSpec Alkyd Semi Gloss Enamel C271
PPG: 6-1110XI Speedhide Alkyd Semi-Gloss Enamel
SW: B34W200 ProMar 200 Alkyd SG Enamel

H. Interior Stained Wood: Provide the following stained finish over new wood (cabinets):

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1. Satin Polyurethane Finish: 2 finish coats of stain polyurethane varnish applied over a semi transparent stain.
   a Stain Coat:
      BM: Benwood Interior Oil Base Wood Stain 241
      PPG: Deft DFT400 Interior Oil Base Wood Stain
      SW: A48 Interior Oil Stain
   b Second Coat (THIN PER MFG. DIRECTIONS):
      BM: N/A
      PPG: Deft DFT127 Interior Oil Based Polyurethane Gloss
      SW: A67V1 Gloss Polyurthane Finish
   c Third Coat:
      BM: N/A
      PPG: Deft DFT127 Interior Oil Based Polyurethane Gloss
      SW: A67V1 Gloss Polyurethane Finish
      OR
      BM: N/A
      PPG: Deft DFT129 Interior Oil Based Polyurethane Satin
      SW: A67F1 Satin Polyurethane Finish

I. Interior Concrete Floors: Provide the following painted finish over new interior concrete floors where a high performance coating is required:
   1. Semi Gloss Epoxy Finish: 3 finish coats of semi gloss epoxy floor coating.
      a. First Coat:
         PPG: Amerlock 2 VOC Epoxy Floor Coating
         SW: Macropoxy 646 Fast Cure Epoxy (B58W00610)
      b. Second Coat:
         PPG: Amerlock 2 VOC Epoxy Floor Coating
         SW: Macropoxy 646 Fast Cure Epoxy (B58W00610)

3.08 SURFACES NOT BE FIELD PAINTED
   A. Acoustical tile and grid.
   B. Concrete floors, except as specified.
   C. Prefinished panels, frames, stair trends, and exterior concrete treads, risers and walks.

END.

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SECTION 101416

PLAQUES

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section includes metal plaques.

1.03 DEFINITIONS
A. Accessible: In accordance with the accessibility standard.

1.04 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**, including raised characters and Braille**, and layout for each plaque at least.
C. Samples for Initial Selection: For each type of plaque, exposed component, and exposed finish.
1. Include representative Samples of available typestyles and graphic symbols.
D. Product Schedule: For plaques. Use same designations indicated on Drawings or specified.

1.05 INFORMATIONAL SUBMITTALS
A. Qualification Data: For **manufacturer**.
B. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS
A. Maintenance Data: For plaques to include in maintenance manuals.

1.07 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

2.01 PERFORMANCE REQUIREMENTS
A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.02 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:

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1. Acceptable Manufacturers:
   a) Gemini Incorporated
   b) Matthews International Company
   c) Ancient Mariner Architectural Sign Manufacturer
   d) Multi-Graphics Inc.
2. Plaque Material: Cast aluminum.
3. Plaque Thickness:**0.50 inch (12.7 mm)**.
4. Finishes:
   a) Integral Aluminum Finish: **Anodized color as selected by Architect from full range of industry colors and color densities**.
5. Background Texture: As selected by Architect from manufacturer's full range.
6. Integrally Cast Border Style: Raised flat band.
7. Applied Frame Material, Style, and Finish: **As indicated on Drawings**.
8. Mounting: Concealed studs.
9. Text and Typeface: Typeface as selected by Architect from manufacturer's full range. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.03 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.

2.04 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. Exposed Metal-Fastener Components, General:
      a) Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
   3. Plaque Mounting Fasteners:
      a) Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.

2.05 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.
   1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques 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. 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.
   4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use con-

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cealed fasteners where possible; use exposed fasteners that match plaque finish.

6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.06 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.

2.07 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, **Class I, 0.018 mm** or thicker.

PART 3 - EXECUTION

3.01 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.

3.02 INSTALLATION

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
   a) Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.

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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.

3.03 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

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SECTION 101419

CAST ALUMINUM LETTERS

PART 1 GENERAL

1.01 SCOPE

A. Furnish letters and hardware necessary to install cast letters shown on drawings and herein specified.

1.02 SUBMITTALS

A. Manufacturer's illustrated product literature and specifications.
B. Installation instructions.

1.03 QUALITY ASSURANCE

A. Manufacturer to have a minimum of 20 years experience in manufacturing letters.
B. All letters to be manufactured by one manufacturer.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Gemini Incorporated (103 Mensing Way, Cannon Falls, MN 55009 Ph: 800-538-8377)
B. Leeds Architectural Letters of Alabama, Inc. (P.O. Box 40, Leeds AL 35094 Ph: 205-699-5271)
C. Other manufacturers may be approved upon request.

2.02 MATERIALS

A. Aluminum

2.03 FINISHES

A. Baked Enamel, bead-blasted returns.

2.04 MOUNTING HARDWARE

A. Cast metal letters have threaded stud bosses for stud insertion.
B. Aluminum letters under 18" use aluminum studs
C. All other letters use stainless steel studs.

2.05 MANUFACTURE

A. Letter shall be Helvetica Bold letterstyle and shall be 10 inches high, and as indicated on the drawings.
B. Mounting shall be projected jam nut and a mounting template designating stud locations is required for mounting on all surfaces.

PART 3 EXECUTION

3.01 INSTALLATION

A. A qualified installer shall install cast letters.

3.02 WARRANTY

A. Letters are to be guaranteed for the life of the business against defects.

END.

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SECTION 101425

IDENTIFYING DEVICES

PART 1 GENERAL

1.01 SUBMITTALS

A. Submit samples of plastic materials and typical sign.

B. Submit shop drawings showing all features, full size profiles of frames, and attachments to the structure of signs and directory.

PART 2 PRODUCTS

2.01 MATERIALS

A. Interior Signs:

1. Room Number and Use Signs: 1/8" thick "ES" plastic high pressure laminate. Colors as selected from manufacturer's standard palette, with white raised letters. Letters and numbers shall be produced by a process to produce 1/32" raised tactile lettering to meet standards set forth in the Americans with Disabilities Act - 1990 (ADA) and CABO/ANSI A117.1-1992. Signs will be attached to top and bottom for temporary holding until mounting adhesive has set. Signs will be attached to walls, doors or glass. At glass, provide a 1/8" thick dark taupe plastic sheet, same size as the sign, and adhere to the opposite side of glass. Provide Grade 2 braille pad in lower right side of sign.
2. Letters and Numbers: Helvetica Medium, sizes and inscriptions as shown on the drawings.
3. Adhesive for Mounting Signs on Walls: silicone-based, permanent adhesive, recommended by the sign manufacturer.
4. Adhesive for Mounting Signs and Back-up Plaques on Glass: all purpose pressure sensitive material specially formulated for smooth surfaces, as recommended by the sign manufacturer.
5. Vinyl Tape: 1/32" thick, specifically produced for permanent mounting of acrylic plastic and recommended by the sign manufacturer. For directional sign panels, provide vinyl tape squares.
6. Available manufacturers include, but are not limited to, Mohawk Sign Systems; Best Sign Systems, and Seton.

B. Handicapped Accessibility Sign:

1. Provide metal reflective signs with the international symbol for accessibility conforming to ANSI and the American Disability Act.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install room number and use signs on walls with the herein specified silicone adhesive, mounted 5'-0" above finish floor to center of sign throughout building, and level. Apply adhesive to effect full coverage over backs of plaques, and press into place to adhere the vinyl tape adhesive to the wall surface. Clean excess adhesive from edges of the signs. Mount on wall adjacent to "latch" side of door.

B. Install room number and use signs on glass with the specified contact adhesive, mounted at same uniform heights as signs mounted on walls. Apply black acrylic backing in precise alignment with front sign members. Clean excess adhesive from glass and plastic.

C. Mount directional signs on walls with concealed fastenings, located at metal studs. Indicate proposed fastening on shop drawings.

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D. After installation, clean exposed surfaces of glass, plastic and aluminum and leave in perfect condition.
E. Install handicapped accessibility sign as indicated on the drawings.

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SECTION 102800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Public-use washroom accessories.
   2. Air dryers.
   3. Childcare accessories.
   4. Custodial accessories.

1.03 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.

1.04 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. 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.

1.05 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.07 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

2.01 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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2.02 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Combination Toilet Tissue Dispenser "TTD":
   1. Acceptable Manufacturers:
      a) Bobrick Washroom Equipment (Basis of Design – 49501-1831 2 roll TP-2 with masterlocks.
      b) Bradley Corporation
      c) American Specialties, Inc.
   2. Description: Combination unit with double-roll toilet tissue dispenser and the following:
   3. Mounting: Surface mounted
   4. Toilet Tissue Dispenser Capacity: 5-inch- (114- or 127-mm-) diameter tissue rolls.
   5. Toilet Tissue Dispenser Operation: Noncontrol delivery with theft-resistant spindles.
   6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
   7. Lockset: Keyed type.

C. Liquid-Soap Dispenser "SD":
   1. Acceptable Manufacturers:
      a) Bobrick Washroom Equipment (Basis of Design – B-306).
      b) Bradley Corporation
      c) American Specialties, Inc.
   2. Description: Designed for dispensing **antibacterial** soap in **liquid or lotion** form.
   3. Mounting: surface mounted.
   4. Lockset: Tumbler type.
   5. Refill Indicator: Window type.

D. Grab Bar "GB36 and GB 42":
   1. Acceptable Manufacturers:
      a) Bobrick Washroom Equipment (Basis of Design – B-5806 x).
      b) Bradley Corporation
      c) American Specialties, Inc.
   2. Mounting: Flanges with **concealed** fasteners.
   3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
      a) Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) **on ends and slip-resistant texture in grip area**.
   4. Outside Diameter: **1-1/4 inches (32 mm) or 1-1/2 inches (38 mm)**.
   5. Configuration and Length: As indicated on Drawings.

E. Sanitary-Napkin Disposal Unit "SND":
   1. Acceptable Manufacturers:
      a) Bobrick Washroom Equipment (Basis of Design – B-254).
      b) Bradley Corporation
      c) American Specialties, Inc.
   2. Mounting: Surface mounted.
   3. Door or Cover: Self-closing, disposal-opening cover **and hinged face panel with tumbler lockset**.
   4. Receptacle: Removable.
   5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

F. Mirror Unit "MIR":
   1. Acceptable Manufacturers:
      a) Bobrick Washroom Equipment (Basis of Design – B-290-1836).
      b) Bradley Corporation
      c) American Specialties, Inc.

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2. Frame: Stainless steel channel.
   a) Corners: **Manufacturer's standard**.
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: 18”x36x1/4”.

2.03 AIR DRYERS

A. Source Limitations: Obtain air dryers from single source from single manufacturer.

B. High-Speed Air Dryer “HD”:
1. Acceptable Manufacturers:
   a) Dyson (Basis of Design) – other manufacturers shall meet the requirements of the Dyson Air Blade V.
   b) Palmer Fixture
   c) Excel
2. Description: High-speed, air hand dryer for rapid hand drying.
3. Mounting: Surface mounted, with low-profile design.
4. Operation: Electronic-sensor activated with operation time of **10 to 20** seconds.

2.04 CHILDCARE ACCESSORIES

A. Source Limitations: Obtain childcare accessories from single source from single manufacturer.

B. Diaper-Changing Station “DCS”:
1. Acceptable Manufacturers:
   a) American Specialties, Inc.
   b) Bradley Corporation
   c) Koala Kare Products
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 (113-kg)** static load when opened.
3. Mounting: Surface mounted, with unit projecting not more than **4 inches (100 mm)** from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: HDPE in manufacturer's standard color

2.05 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Mop and Broom Holder “MBH”:
1. Acceptable Manufacturers:
   a) Bobrick Washroom Equipment (Basis of Design – B-223 x 48).
   b) Bradley Corporation
   c) American Specialties, Inc.
2. Length: 48 **inches (914 mm)**.
3. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.06 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.

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B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of [**six**] keys to Owner's representative.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F446.

3.02 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

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SECTION 104416

FIRE EXTINGUISHERS

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section includes portable, fire extinguishers and mounting brackets for fire extinguishers.
B. Related Requirements:
1. Section 233813 "Commercial-Kitchen Hoods" for fire-extinguishing systems provided as part of commercial-kitchen exhaust hoods.

1.03 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.

1.04 INFORMATIONAL SUBMITTALS
A. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.06 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

2.01 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.

2.02 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS
A. Fire Extinguishers: Type, size, and capacity for each **fire-protection cabinet and mounting bracket** indicated.
1. Acceptable Manufacturers:
A. Amerex Corporation.
B. Buckeye Fire Equipment Co.

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C. General Fire Extinguisher Corporation.
D. Walter Kidde, The Fire Extinguisher Co.
a) J.L. Industries, Inc.

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, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container **FE-1 and FEC-1**: UL-rated 4-A:80-B:C, **10-lb (4.5-kg)** nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

C. Multipurpose Dry-Chemical Type in Steel Container **FE-2**: UL-rated 10-A:120-B:C, **20-lb (9.1-kg)** nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

D. Purple-K Dry-Chemical Type in Stainless Steel Container **FE-K**: UL-rated (A)2-A:K. 2.5 gallon nominal capacity, with potassium bicarbonate-based dry chemical in stainless steel container.

2.03 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard **galvanized** 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**.

2.04 CABINET FEC-1:

1. To house one extinguisher.
a) Extinguisher: FE-1.
2. Size: Suitable size for housing fire extinguisher of type and capacity indicated.
3. Style: Semi recessed mounted, with overlapping trim, door flush with trim and 3” rolled edge.
4. Vertical Duo Panel, with frame.
a) Acrylic glazing.
1) Clear.
b) Door material: Stainless steel, satin finished.
c) Surface mounted door handle, finished to match door.
d) Friction or roller catch.
5. Trim (box flange or frame): Same material and finish as door.
6. No lettering on door or trim.
7. Box: Stainless steel sheet, satin finish interior.
8. Provide wall bracket for extinguisher, inside cabinet.
9. Hinges: Provide hinges for each door; concealed or continuous type; allow full 180 degree opening of door.
10. Exposed hinges: Finish to match door.
11. Acceptable Manufacturers:
a) J.L. Industries.
b) Larsen’s Manufacturing Co.
c) Potter-Romer, Inc.
12. One hour fire resistance rating for all cabinets located within fire rated walls.

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PART 3 - EXECUTION

3.01 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.

3.02 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 **42 inches (1067 mm)** above finished floor.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

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SECTION 114000

FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL

A. Refer to Division 15 sections for specified drain traps, steam traps, atmospheric vents, valves, pipes and pipe fittings, ductwork, and other materials necessary to complete mechanical hookup of food service equipment, which is not work of this section.

B. Refer to Division 16 sections for wiring, disconnects, and other materials necessary to complete electrical hookup of food service equipment, which is not work of this section.

C. Codes and Standards:

1. NSF Standards: Comply with applicable National Sanitation Foundation (NSF) standards and recommended criteria (current edition). Provide each principal item of food service equipment with a NSF "Seal of Approval".
2. UL Labels: Where available, provide UL labels on prime electrical components of food service equipment. Provide UL "recognized marking" on other items with electrical components, signifying listing by UL, where available.
3. ANSI Standards: Comply with applicable ANSI standards for electric powered and gas-burning appliances, and for plumbing fittings including vacuum breakers and air gaps to prevent siphonage in water piping.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each item; include roughing-in dimensions, service connection requirements, performances, materials, manufacturer's model numbers, furnished accessories, power/fuel requirements, water/drainage requirements, and other similar information.

B. Shop Drawings: Submit dimensioned roughing-in drawings, at minimum of scale 1/4" = 1'-0", showing mechanical and electrical specifications. Submit dimensioned fabrication drawings for custom fabricated equipment including pans, elevations, and sections, showing materials and gages used.

C. Maintenance Data: Submit maintenance data and parts lists for each item of food service equipment. Include this data, product data, shop drawings, and wiring diagrams in a bound maintenance manual; furnish two copies.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver food service equipment in factory-fabricated containers designed to protect equipment and finish until final installation.

B. Store food service equipment in original containers, and in location to provide protection to equipment.

1.04 PROJECT CONDITIONS

A. Take field measurements to assure fit of fabricated equipment.

B. Check electrical characteristics, and water, steam, and gas pressure. Provide pressure regulating valves for proper operation of equipment.

C. Electrical Requirements: Provide motors and heating elements for the following electrical characteristics, if not otherwise indicated on the drawings or herein:

1. Motors ½ HP and Smaller: 120/1/60.
2. Motors 3/4 HP and Larger: 208/3/60.
3. Heating Elements 1500 Watts and Smaller: 120/1/60.

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4. Heating Elements over 1500 Watts: 208/3/60.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Prior approval by the Owner will be required on proposed equal products to the items listed below. Detailed comparisons and cut sheets shall be submitted to the architect and received no later than ten (10) days prior to the bid date to be considered.

1. **ONE (1) REQUIRED ICE MACHINE AND STORAGE BIN – HOSHIZAKI Model No. KM-320MAH** with water filter system and required top kit, **Storage Bin B-500PF**; or by Scotsman or Manitowoc.
   a) Three (3) year parts and labor warranty.
   b) Five (5) years arts and labor warranty on Evaporator.
   c) Five (5) year parts and three (3) year labor warranty on Compressor.
   d) 120V
   e) Provide lock on storage bin.
   f) Provide TCSystem 20 by Terry water filter.

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SECTION 220000

GENERAL PLUMBING PROVISIONS

PART 1 - GENERAL

1.01 Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

A. This Section includes general provisions covering the contract documents for Plumbing Systems.

1.03 DEFINITIONS

A. Provide shall mean "Furnish, install and connect."

B. Piping shall mean "pipe installed with all specified fittings, valves and accessories, and forming a complete system."

1.04 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.

B. Electrical Coordination: In addition to submittal requirements of other Division 22 Sections, submit a document approved by the project Electrical Contractor certifying that all mechanical equipment being furnished under Division 22 complies with the electrical characteristics of the source power which will be furnished under Divisions 26 and 27.

C. Model numbers listed on the Mechanical Contract Documents shall not be construed to indicate electrical characteristics. Electrical characteristics of mechanical equipment shall be as indicated on the Electrical Contract Documents (Division 26).

D. Review of Submittals does not relieve the Contractor of any of the requirements of the Contract Documents. Failure by the Engineer to document errors and omissions in the Contractor's submittals during the Engineer's submittal review does not constitute a waiver of any of the requirements of the original Contract Documents.

1.05 CONTRACTOR QUALIFICATIONS

A. Plumbing Subcontractor shall have a Class II Unlimited License and shall have demonstrated proficiency in the installation of plumbing systems by the successful installation of systems similar to those included in the Construction Documents for this project. Such systems shall have been installed in commercial or institutional buildings having a minimum of 150 plumbing fixtures (in a single building). The Subcontractor shall have been in business as described above for a minimum period of five years.

B. A master or journeyman plumber shall be present at the site during the installation of all plumbing related work. The master or journeyman plumber shall be certified in the state in which the construction is being performed and shall have his license present at site or on file during construction.

C. Medical Gas System installer qualifications shall be specified in other sections of Division 22.

1.06 PRIOR APPROVALS

A. Manufacturers References: When reference is made in the Contract Documents to trade names or specific manufacturers and/or models, such reference, unless noted otherwise, is made to designate and identify the quality of materials or equipment to be furnished and is not intended to restrict competitive bidding. If it

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is desired to use materials or equipment different from those indicated on the Contract Documents, written request for approval must reach the hands of the Design Professional at least TEN DAYS prior to the date set for the opening of bids. A copy of the request should also be sent directly to the Engineer. Requests for prior approval of a proposed substitute shall be accompanied by complete technical data supporting the request.

B. Request for Prior Approval by facsimile transmission (fax) or email will not be considered. Prior approval requests shall be submitted in hard copy format only.

1.07 LAYOUT AND COORDINATION

A. Layout Basis:

1. The equipment listed on the Drawings and in the Specifications has been used for the physical arrangement of the mechanical systems. When equipment listed as acceptable, equal or equipment which has received "prior approval" is used, it shall be the Contractor's responsibility to provide structural, ductwork, electrical, service clearances, or other changes required to accommodate the substituted equipment. Changes shall be made at no additional cost to the Owner. Submit a list of required changes along with all prior approval requests and shop drawing submittals.
2. The Contract Drawings are intended to show the general arrangement of all mechanical work. They do not show in detail all offsets, fittings and transitions. Examine Drawings, investigate site conditions to be encountered and arrange work accordingly. Furnish all offsets and transitions required.
3. Drawings do not indicate in detail exact configuration of connections for fixtures, equipment and accessories. Final connection shall be as shown on approved Manufacturer's Submittal Drawings. Where Manufacturer's Submittal Drawings conflict with the Contract Documents, confer with the Design Professional for resolution.
4. Measurement of Drawings by scale shall not be used as dimensions for fabrication. Measurements for locating fixtures, equipment, ductwork, piping and other mechanical items shall be made on the site and shall be based on actual job conditions.
5. Check space limitations and verify electrical requirements before ordering any mechanical equipment or materials. Place large equipment inside the building prior to the erection of exterior walls where equipment cannot enter finished building openings.

B. Coordination: Mechanical work shall be coordinated with that of other trades to avoid conflict. The Contractor shall study all plans and specifications for this project and shall notify the Design Professional of any conflict between work under Division 22 and work under other divisions of the Project. Particular attention shall be given to interference between piping, electrical installations, structural systems, building openings and ductwork.

C. Installation Instructions: Two binders containing manufacturer's installation instructions for all equipment furnished under Division 22 shall be furnished by the Contractor. One binder shall be kept in the General Contractor's office at the job site. The other binder shall be delivered to the Engineer upon acceptance by the Design Professional of the Submittals.

D. Operation and Maintenance Instructions: Three copies of equipment O&M manuals contained in rigid 3-ring binders shall be submitted to the Owner a minimum of 15 days prior to equipment/systems training. Binders shall have permanent labels on the spine and front cover indicating project name, project number, building name and contents. Model and serial numbers of equipment shall be shown on the cover of their respective O&M manual(s).

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1.08 PERMITS

A. Obtain all necessary Permits and Inspections required for the installation of this work and pay all charges incident thereto. Deliver to the Design Professional all certificates of inspection issued by authorities having jurisdiction.

B. Sewer tap fees, water tap fees, meter fees, Dept. of Labor Fees for Boilers and Pressure Vessels and all other charges for work under Division 22, including charges for meter installation and excess service by the Gas Company or any other utilities shall be paid by the Contractor.

1.09 SAFETY

A. OSHA Requirements applicable to the project shall be complied with at all times.

B. Manufacturer's Safety Instructions shall be followed in all instances.

C. Asbestos Containing Materials (ACM) shall not be used on this project.

D. Refrigerants containing CFC's or HCFC's shall not be used on this project, nor shall any equipment using such refrigerants be incorporated into this project.

E. Electrical Equipment Clearances: Piping, equipment and other mechanical installations shall not be located within 42" of the front or 36" of the side of any electrical switchboards, panelboards, power panels, motor control centers, electrical transformers or similar electrical equipment. Piping and ductwork shall not pass through or above electrical equipment rooms except as required to serve those rooms.

F. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof or grade below. The guard shall extend not less than 30 inches beyond each end of such appliances, equipment, fans, components and roof hatch openings and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21 inch diameter sphere and shall comply with the loading requirements for guards specified in the International Building Code.

1.10 PROTECTION OF PLUMBING SYSTEMS DURING CONSTRUCTION:

A. Material storage:

1. All materials and equipment stored on the jobsite shall be elevated above the ground and stored under suitable weather cover. Materials and equipment shall not be situated in areas subjected to localized flooding.
2. Manufacturer's original shipping packaging and protective coverings shall be left in place until the equipment is prepared for installation.

B. Roof protection: All penetrations through roofs, including roof vents and roof drainage system elements shall be properly protected during construction to prevent water intrusion into the building. Protective measures could include temporary covers and plugs, as well as other appropriate temporary elements.

C. Electrical enclosure protection

1. During construction, all protective covers and other devices shall be left in place that protect against inadvertent contact with live electrical circuits.
2. All warning labels related to electrical and rotating equipment hazards shall be in place prior to energizing mechanical equipment circuits.

D. Protection of equipment and piping

1. Maintain temporary closures on the ends of all equipment and pipes as the installation work progresses. Temporary closures include plastic sheeting, tape and appropriate caps and covers.

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2. Where debris enters piping during installation, steps shall be taken to clean the interior of the pipe prior to placing in service.
3. Where debris enters equipment during installation the duct interior shall be cleaned prior to placing in service.

1.11 CODES AND STANDARDS

A. Mechanical installations shall conform to the current edition of the following, in addition to any previously mentioned Codes and Standards.
1. The International Building Code.
2. The International Mechanical Code.
3. The International Plumbing Code.
4. The International Fire Protection Code.
5. The State Energy Code.
6. NFPA Standard 70, National Electric Code.
7. NFPA Standard 101, Code for Safety to Life for Fire in Buildings and Structures.

1.12 ASBESTOS MATERIALS

A. Contractor is advised there may be ASBESTOS PRODUCTS in building(s) which will affect work under this Project. Particular reference is made to piping, equipment and other items that may be modified or removed. It shall be the sole responsibility of Contractor to check for and ascertain presence of asbestos materials where such presence affects work under this Project. Where Contractor ascertains presence of asbestos materials, he shall notify Owner and Engineer in writing of presence of asbestos BEFORE beginning any work. Removal of asbestos products shall be the responsibility of Owner AFTER he has been notified by Contractor of its presence.

B. Engineer assumes no responsibility of investigating for presence of ASBESTOS PRODUCTS or for verifying presence of asbestos materials, nor does Engineer assume any responsibility for specifying, advising on, or supervising removal of any asbestos products. Contractor and Owner shall hold harmless Engineer in any matters involving presence of, or removal of, asbestos products.

1.13 INTERRUPTION OF EXISTING SERVICES

A. Exercise care so as not to cut any existing utilities or services. Where an existing utility line or service line is cut it shall be repaired to "like-new" condition. Interruption of service shall not be made without prior written permission of the Owner.

B. Plumbing system must remain in service during construction. Arrange with the Owner well in advance of shutdowns required for tie-ins. Shutdowns shall be made after normal occupancy hours if so directed by the Owner. No additional monies will be paid for after-hours shutdowns.

PART 2 - PRODUCTS Not required for this section.

PART 3 - EXECUTION Not required for this section.

END OF SECTION 220000

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SECTION 220500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract apply to this Section.

1.02 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 22 sections.
   1. Piping materials and installation instructions common to most piping systems.
   2. Equipment nameplate data requirements.
   3. Labeling and identifying mechanical systems and equipment is specified in Division 22.
   4. Non-shrink grout for equipment installations.
   5. Field-fabricated metal and wood equipment supports.
   6. Installation requirements common to equipment specification Sections.
   7. Cutting and patching.
   8. Touchup painting and finishing.

B. Pipe and pipe fitting materials are specified in piping system Sections.

1.03 DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.04 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract.

B. Product data for following piping specialties:
   1. Mechanical sleeve seals.
   2. Identification materials and devices.

C. Samples of color, lettering style, and other graphic representation required for each identification material and device.

D. Shop drawings detailing fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

E. Coordination drawings for access panel and door locations.

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F. Prepare coordination drawings of Mechanical Rooms to a 1/4 inch equals 1 foot scale or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:
   1. Proposed locations of piping, ductwork, equipment, and materials. Include the following:
      a. Planned piping layout, including valve and specialty locations and valve stem movement.
      b. Planned duct systems layout, including elbow radii and duct accessories.
      c. Clearances for installing and maintaining insulation.
      d. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
      e. Equipment service connections and support details.
      f. Exterior wall and foundation penetrations.
      g. Fire-rated wall and floor penetrations.
      h. Sizes and location of required concrete pads and bases.
   2. Scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
   3. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

G. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

1.05 QUALITY ASSURANCE

A. Qualify welding processes and operators for structural steel according to AWS D1.1 "Structural Welding Code--Steel."

B. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

C. ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

D. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

E. Coordinate all electrical service requirements for mechanical equipment prior to the submittal of shop drawings. Confirm the compatibility of all power services with the equipment being furnished. Confirm compatibility of electrical lugs being provided by the equipment manufacturer with the power wiring being furnished under Division 26. Furnish written documentation that all characteristics have been coordinated with and confirmed by the electrical subcontractor.

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1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Protect stored plastic pipes from direct sunlight. Support to prevent sagging and bending.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.02 JOINING MATERIALS

A. Refer to individual piping system specification Sections in Division 22 for special joining materials not listed below.

B. Brazing Filler Metals: AWS A5.8.

1. BCuP-5 Series: Copper-phosphorus alloys.

C. Solvent Cements: Manufacturer's standard solvents complying with the following:

1. Poly (Vinyl Chloride) (PVC): ASTM D 2564.

2. PVC to ABS Transition: Made to requirements of ASTM D 3138, color other than orange.

2.03 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type where required to conceal protruding fittings and sleeves.

1. Inside Diameter: Closely fit around pipe, tube, and insulation.

2. Outside Diameter: Completely cover opening.

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3. Cast Brass: One-piece, with set-screw.
    a. Finish: Polished chrome plate.
4. Cast Brass: Split casting, with concealed hinge and set-screw.
    a. Finish: Polished chrome plate.
5. Stamped Steel: One-piece, with set-screw and chrome-plated finish.
6. Stamped Steel: Split plate, with concealed hinge, set-screw, and chrome-plated finish.
7. Stamped Steel: Split plate, with exposed-rivet hinge, set-screw, and chrome-plated finish.
8. Cast-Iron Floor Plate: One-piece casting.

B. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.
1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
2. Insulating Material: Suitable for system fluid, pressure, and temperature.
3. Dielectric Unions: Factory-fabricated, union assembly for 250-psig minimum working pressure at a 180 deg F temperature.
4. Dielectric Flanges: Factory-fabricated, companion-flange assembly for 150- or 300-psig minimum pressure to suit system pressures.
5. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
    a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
6. Dielectric Couplings: Galvanized-steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225 deg F temperature.
7. Dielectric Nipples: Electroplated steel nipple, having inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig working pressure at 225 deg F temperature.

C. Mechanical Sleeve Seals: Modular, watertight mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.

D. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
1. Steel Sheet-Metal: 24-gage or heavier galvanized sheet metal, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast-Iron: Cast or fabricated wall pipe equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.
    a. Penetrating Pipe Deflection: 5 percent without leakage.
    b. Housing: Ductile-iron casting having water-stop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
    c. Pipe Sleeve: AWWA C151, ductile-iron pipe.
    d. Housing-to-Sleeve Gasket: Rubber or neoprene push-on type of manufacturer's design.

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5. Cast-Iron Sleeve Fittings: Commercially made sleeve having an integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.
    a. Underdeck Clamp: Clamping ring with set-screws.

2.04 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22 Sections. Where more than one type is specified for listed application, selection is Installer's option, but provide single selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped, permanently fastened to equipment.
    1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
    2. Location: An accessible and visible location.

C. Stencils: Standard stencils, prepared for required applications with letter sizes conforming to recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch -high letters for ductwork and not less than 3/4-inch -high letters for access door signs and similar operational instructions.
    1. Material: Fiberboard.
    2. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
    3. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

D. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid snap-on, color-coded pipe markers, conforming to ASME A13.1.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, conforming to ASME A13.1.

F. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white (letter color) melamine subcore, except when other colors are indicated.
    1. Fabricate in sizes required for message.
    2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
    3. Punch for mechanical fastening.
    4. Thickness: 1/16 inch, except as otherwise indicated.
    5. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.

G. Plastic Equipment Markers: Laminated-plastic, color-coded equipment markers. Conform to following color code:
    1. Blue: Equipment and components.
    2. For hazardous equipment, use colors and designs recommended by ASME A13.1.
    3. Nomenclature: Include following, matching terminology on schedules as closely as possible:
        a. Name and plan number.
        b. Equipment service.
        c. Design capacity.
        d. Other design parameters such as pressure drop, entering and leaving conditions, and rpm.

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4. Size: Approximately 2-1/2 by 4 inches for control devices, dampers, and valves; and 4-1/2 by 6 inches for equipment.

H. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: Where multiple systems of same generic name are indicated, provide identification that indicates individual system number as well as service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

2.05 FIRE-STOPPING

A. Fire-Resistant Sealant: Provide UL Listed firestopping system for filling openings around penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Products: Subject to compliance with requirements, provide products by one of the following:
1. Specified Technologies, Inc.
2. 3M Corporation
3. Metacaulk.
4. Hilti, Inc.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS--COMMON REQUIREMENTS

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 22 specify piping installation requirements unique to the piping system.

B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

C. Install piping at indicated slope.

D. Install components having pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's printed instructions.

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M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, suspended ceilings, cabinet interiors and other exposed locations, according to the following:
   1. Chrome-Plated Piping: Cast-brass, one-piece, with set-screw, and polished chrome-plated finish. Use split-casting escutcheons, where required, for existing piping.
   2. Uninsulated Piping Wall Escutcheons: Cast-brass or stamped-steel, with set-screw.
   3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
   4. Insulated Piping: Cast-brass or stamped-steel, with concealed hinge and chrome-plated finish.
   5. Piping in Utility Areas: Cast-brass or stamped-steel, with set-screw clips.

N. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, exterior walls and where indicated.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
   2. Build sleeves into new walls and slabs as work progresses.
   3. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Steel Pipe Sleeves: For pipes smaller than 6 inches.
      b. Steel Sheet-Metal Sleeves: For pipes 6 inches and larger that penetrate gypsum-board partitions.
      c. Cast-Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
         1) Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.

O. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with U.L. Listed firestopping sealant system.

P. Verify final equipment locations for roughing in.

Q. Refer to equipment specifications in other Sections for roughing-in requirements.

R. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
   1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   3. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.
   4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
      a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
      b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
      c. Align threads at point of assembly.

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d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

6. Plastic Pipe and Fitting Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following standards:
a. Comply with ASTM F 402 for safe handling of solvent-cement and primers.
b. Poly (Vinyl Chloride) (PVC) Non-Pressure Application: ASTM D 2855.
c. PVC to ABS (Non-Pressure) Transition: Procedure and solvent cement described in ASTM D 3138.

S. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
1. Install unions in piping 2 inches and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch or smaller threaded pipe connection.
2. Install dielectric unions and flanges to connect piping materials of dissimilar metals.

3.02 EQUIPMENT INSTALLATION--COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Design Professional.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.03 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
1. Stenciled Markers: Complying with ASME A13.1.
2. Plastic markers, with application systems. Install on pipe insulation segment where required for hot non-insulated pipes.
3. Locate pipe markers wherever piping is exposed in finished spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), and exposed exterior locations as follows:
a. Near each valve and control device.
b. Near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
c. Near locations where pipes pass through walls, floors, ceilings, or enter inaccessible enclosures.
d. At access doors, manholes, and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.

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f. Spaced at a maximum of 50-foot intervals along each run. Reduce intervals to 25 feet in congested areas of piping and equipment.

g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

B. Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment.

1. Lettering Size: Minimum 1/4-inch -high lettering for name of unit where viewing distance is less than 2 feet, 1/2-inch -high for distances up to 6 feet, and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

2. Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.

C. Adjusting: Relocate identifying devices which become visually blocked by work of this Division or other Divisions.

3.04 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

B. Paint all exposed steel surfaces of piping and supports with one coat of primer and two coats of enamel.

3.05 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code--Steel."

3.06 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair cut surfaces to match adjacent surfaces.

END OF SECTION 220500

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SECTION 220519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY
A. This Section includes meters and gages used in mechanical systems.

1.03 SUBMITTALS
A. General: Submit the following according to the Conditions of the Contract.
B. Product data for each type of meter, gage, and fitting specified. Include scale range, ratings, and calibrated performance curves. Submit a meter and gage schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gage.

1.04 QUALITY ASSURANCE
A. Comply with applicable portions of American Society of Mechanical Engineers (ASME) and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gages.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Pressure Gages:
a. AMETEK, U.S. Gauge Div.
b. Ashcroft by Dresser Industries, Instrument Div.
c. Marsh Instrument Co.
d. Marshalltown Instruments, Inc.
e. H.O. Trerice Co.
f. Weiss Instruments, Inc.
g. Weksler Instruments Corp.
h. WIKA Instruments Corp.

2.02 PRESSURE GAGES
A. Description: ASME B40.1, Grade A phosphor-bronze Bourdon-tube pressure gage, with bottom connection.
B. Case: Drawn steel, brass, or aluminum with 4-1/2-inch -diameter glass lens.
C. Connector: Brass, 1/4-inch.
D. Scale: White-coated aluminum, with permanently etched markings.
E. Accuracy: Plus or minus 1 percent of range span.
F. Range: Conform to the following:
1. Fluids Under Pressure: 2 times operating pressure.

2.03 PRESSURE-GAGE ACCESSORIES
A. Snubbers: 1/4-inch brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

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PART 3 - EXECUTION

3.01 METER AND GAGE APPLICATIONS

A. General: Where indicated, install meters and gages of types, sizes, capacities, and with features indicated.

3.02 METER AND GAGE INSTALLATION, GENERAL

A. Install meters, gages, and accessories according to manufacturers' written instructions for applications where used.

3.03 PRESSURE GAGE INSTALLATION

A. Install pressure gages in piping tee with pressure gage valve located on pipe at most readable position. Install in locations indicated on the drawings.

B. Install in the following locations and elsewhere as indicated:

1. At building water service entrance.

C. Pressure Gage Needle Valves: Install in piping tee with snubber.

3.04 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. The Drawings indicate the general arrangement of piping, fittings, and specialties.

B. Install meters and gages adjacent to machines and equipment to allow servicing and maintenance.

3.05 ADJUSTING AND CLEANING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjusting: Adjust faces of meters and gages to proper angle for best visibility.

C. Cleaning: Clean windows of meters and gages and factory-finished surfaces. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION 220519

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SECTION 220523

GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

A. This Section includes general duty valves common to several mechanical piping systems.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.

B. Product Data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

C. Maintenance data for valves to include in the operation and maintenance manual. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.04 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

B. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Valve Co.
   2. Crane Company; Valves and Fitting Division.
   3. Hammond Valve Corporation.
   4. Appollo/Conbraco Ind. Inc.
   5. Milwaukee Valve Company, Inc.
   6. NIBCO Inc.
   7. Powell Valves

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8. Red-White Valve Corp.
9. Stockham Valves & Fittings, Inc.
10. Kitz Corporation of America

2.02 BASIC, COMMON FEATURES

A. Design: Rising stem or rising outside screw and yoke stems, except as specified below.
   1. Non-rising stem valves may be used only where headroom prevents full extension of rising stems.
B. Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.
C. Sizes: Same size as upstream pipe, unless otherwise indicated. All valves shall be a full port design.
D. Operators: Use specified operators and handwheels, except provide the following special operator features:
   1. Lever Handles: For quarter-turn valves 6 inches and smaller.
E. Threads: ASME B1.20.1.

2.03 BALL VALVES

A. Ball Valves, 4 Inches and Smaller: MSS SP-110, Class 150, 600-psi CWP, ASTM B 584 bronze body and bonnet, 2-piece construction with threaded packing gland on the valve stem seal; chrome-plated brass ball, full port; blowout proof; bronze or brass stem; teflon seats and seals:
   1. Operator: Vinyl-covered steel tee handle.
   2. Threaded end connection.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.
B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.
D. Examine threads on valve and mating pipe for form and cleanliness.
E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
F. Do not attempt to repair defective valves; replace with new valves.

3.02 INSTALLATION

A. Install valves as indicated, according to manufacturer's written instructions.
B. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.
C. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.
D. Locate valves for easy access and provide separate support where necessary.
E. Install valves in horizontal piping with stem at or above the center of the pipe.
F. Install valves in a position to allow full stem movement.

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3.03 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.04 VALVE END SELECTION

A. Select valves with the following ends or types of pipe/tube connections:

1. Copper Tube Size, 2-1/2 Inches and Smaller: Solder ends or threaded ends.

3.05 APPLICATION SCHEDULE

A. General Application: Use ball for shutoff duty. Refer to piping system Specification Sections for specific valve applications and arrangements.

B. Domestic Water Systems: Use the following valve types:

1. Ball Valves: Class 150, 600-psi CWP.

3.06 ADJUSTING

A. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

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SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawing and general provisions of the Contract apply to this Section.

1.02 SUMMARY
A. This Section includes hangers and supports for mechanical systems piping and equipment.

1.03 DEFINITIONS
A. Terminology used in this Section is defined in MSS SP-90.

1.04 PERFORMANCE REQUIREMENTS
A. Design and obtain approval from authority with jurisdiction over seismic restraint hangers and supports for piping and equipment.

1.05 SUBMITTALS
A. General: Submit the following according to the Conditions of the Contract.
B. Product data for each type of hanger and support.
C. Submit pipe hanger and support schedule showing manufacturer's Figure No., size, location, and features for each required pipe hanger and support.
D. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
E. Shop drawings for each type of hanger and support, indicating dimensions, weights, required clearances, and methods of component assembly.

1.06 QUALITY ASSURANCE
A. Qualify welding processes and welding operators according to AWS D1.1 "Structural Welding Code--Steel."
1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
B. Qualify welding processes and welding operators according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
C. NFPA Compliance: Comply with NFPA 13 for hangers and supports used as components of fire protection systems.
D. Listing and Labeling: Provide hangers and supports that are listed and labeled as defined in NFPA 70, Article 100.
1. UL and FM Compliance: Hangers, supports, and components include listing and labeling by UL and FM where used for fire protection piping systems.
E. Licensed Operators: Use operators that are licensed by powder-operated tool manufacturers to operate their tools and fasteners.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS
A. Hangers, Supports, and Components: Factory-fabricated according to MSS SP-58.
1. Components include galvanized coatings or alternate rust preventing shop coating.

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2. Pipe attachments include nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

B. Thermal-Hanger Shield Inserts: 100-psi average compressive strength, waterproofed calcium silicate, encased with sheet metal shield. Insert and shield cover entire circumference of pipe and are of length indicated by manufacturer for pipe size and thickness of insulation.

C. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

D. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

2.02 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36, steel plates, shapes, and bars, black and galvanized.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.

C. Washers: ASTM F 844, steel, plain, flat washers.

D. Grout: ASTM C 1107, Grade B, non-shrink, nonmetallic.

1. Characteristics include post-hardening, volume-adjusting, dry, hydraulic-cement-type grout that is non-staining, noncorrosive, nongaseous and is recommended for both interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Water: Potable.
4. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in the Section specifying the equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping specification Sections.

3.02 HANGER AND SUPPORT INSTALLATION

A. General: Comply with MSS SP-69 and SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible.

C. Install supports with maximum spacings complying with MSS SP-69.

D. Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

E. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Install reinforcing bars through openings at top of inserts.

F. Install concrete inserts in new construction prior to placing concrete.

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G. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches thick.

H. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches thick.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Heavy-Duty Steel Trapezes: Field-fabricate from ASTM A 36 steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

K. Support all piping direct from structure and independent of other piping.

L. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9 "Building Services Piping" is not exceeded.

O. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

3. Shields: Install MSS Type 40, protective shields on insulated piping. Shields span an arc of 180 degrees and have dimensions in inches not less than the following:

NPS (Inches)	LENGTH (Inches)	THICKNESS (Inches)
1/4 to 3-1/2	12	0.048
4	12	0.060
5 and 6	18	0.060
8 to 14	24	0.075
16 to 24	24	0.105

4. Pipes 6 Inches and Larger: Include shield inserts.

5. Insert Material: Length at least as long as the protective shield.

6. Thermal-Hanger Shields: Install with insulation of same thickness as piping.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.

B. Grouting: Place grout under supports for equipment and make a smooth bearing surface.

3.04 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for pipe and equipment supports.

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B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.06 PAINTING

A. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

C. Paint all exposed steel surfaces with one coat of primer and two coats of enamel.

END OF SECTION 220529

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SECTION 220700

PLUMBING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of Contract apply to this Section.

1.02 SUMMARY
- A. This Section includes pipe and equipment insulation.

1.03 DEFINITIONS
- A. Hot Surfaces: Normal operating temperatures of 100 deg F or higher.
- B. Dual-Temperature Surfaces: Normal operating temperatures that vary from hot to cold.
- C. Cold Surfaces: Normal operating temperatures less than 75 deg F.
- D. Thermal resistivity is designated by an r-value that represents the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivity (r-value) is expressed by the temperature difference in degrees Fahrenheit between the two exposed faces required to cause 1 BTU per hour to flow through 1 square foot at mean temperatures indicated.
- E. Thermal Conductivity (k-value): Measure of heat flow through a material at a given temperature difference; conductivity is expressed in units of Btu x inch/h x sq. ft. x deg F.
- F. Density: Is expressed in lb./cu.ft.

1.04 SUBMITTALS
- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data for each type of mechanical insulation identifying k-value, thickness, and accessories.

1.05 QUALITY ASSURANCE
- A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.
  1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.
  2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

1.06 SEQUENCING AND SCHEDULING
- A. Schedule insulation application after testing of piping systems.
- B. Schedule insulation application after installation and testing of heat trace tape.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. Glass Fiber:
    a. CertainTeed Corporation.
    b. Knauf Fiberglass GmbH.
    c. Manville.
    d. Owens-Corning Fiberglas Corporation.
    e. USG Interiors, Inc. - Thermafiber Division.
2. Flexible Elastomeric Cellular:
    a. Armaflex; Armacell LLC
    b. Halstead Industrial Products.
    c. K-Flex; Nomaco K-Flex Corporation.
    d. Aerocel; Aeroflex USA, inc.

2.02 GLASS FIBER

A. Material: Inorganic glass fibers, bonded with a thermosetting resin.

B. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.

C. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, jacketed.
1. Thermal Conductivity: 0.26 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F mean temperature.
2. Density: 3 pcf minimum.

D. Adhesive: Produced under the UL Classification and Follow-up service.
1. Type: Non-flammable, solvent-based.
2. Service Temperature Range: Minus 20 to 180 deg F.

E. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

2.03 FLEXIBLE ELASTOMERIC CELLULAR

A. Material: Flexible expanded closed-cell structure with smooth skin on both sides.
1. Tubular Materials: ASTM C 534, Type I.
2. Sheet Materials: ASTM C 534, Type II.

B. Thermal Conductivity: 0.30 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F.

C. Coating: Water based latex enamel coating recommended by insulation manufacturer.

D. Fire Performance Characteristics: Provide material having the following fire performance characteristics as determined by UL in accordance with ASTM Standard E84:
Flame Spread = 25
Smoke Developed = 50

2.04 INSULATING CEMENTS

A. Mineral Fiber, Hydraulic-Setting Insulating and Finishing Cement: ASTM C 449.
1. Thermal Conductivity: 1.2 Btu x inch/h x sq. ft. x deg F average maximum at 400 deg F mean temperature.
2. Compressive Strength: 100 psi at 5 percent deformation.

2.05 ADHESIVES

A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive recommended by insulation manufacturer.

B. Lagging Adhesive: MIL-A-3316C, non-flammable adhesive in the following Classes and Grades:
1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to unfaced glass fiber insulation.
2. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

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2.06 JACKETS

A. General: ASTM C 921, Type 1, except as otherwise indicated.

B. Foil and Paper Jacket: Laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
   1. Water Vapor Permeance: 0.02 perm maximum, when tested according to ASTM E 96.
   2. Puncture Resistance: 50 beach units minimum, when tested according to ASTM D 781.

C. PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20 mil thick, high-impact, ultra-violet-resistant PVC.
   1. Adhesive: As recommended by insulation manufacturer.

2.07 SEALING COMPOUNDS

A. Vapor Barrier Compound: Water-based, fire-resistive composition.
   1. Water Vapor Permeance: 0.08 perm maximum.
   2. Temperature Range: Minus 20 to 180 deg F.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.

B. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless-steel surfaces with demineralized water.
   1. Follow cement manufacturer's printed instructions for mixing and portions.

3.02 INSTALLATION, GENERAL

A. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical system.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

C. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 60 deg F.

D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight, and even surfaces.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

I. Apply adhesives and coatings at manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

K. Items Not Insulated: Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment:
   1. Vibration control devices.
   2. Testing laboratory labels and stamps.
   3. Nameplates and data plates.

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4. Sanitary drainage and vent piping. (Drainage piping receiving air conditioning condensate shall be insulated.)
5. Drainage piping located in crawl spaces, unless indicated otherwise.
6. Below grade piping.
7. Chrome-plated pipes and fittings, except for plumbing fixtures for the disabled.

3.03 PIPE INSULATION INSTALLATION, GENERAL

A. Tightly butt longitudinal seams and end joints. Bond with adhesive.
B. Stagger joints on double layers of insulation.
C. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.
D. Apply insulation with a minimum number of joints.
E. Apply insulation with integral jackets as follows:
   1. Pull jacket tight and smooth.
   2. Cover circumferential joints with butt strips, at least 3 inches wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches on center.
   3. Longitudinal Seams: Overlap seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center.
      a. Exception: Do not staple longitudinal laps on insulation applied to piping systems with surface temperatures at or below 35 deg F.
   4. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.
   5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.
   6. Repair damaged insulation jackets, except metal jackets, by applying jacket material around damaged jacket. Adhere, staple, and seal. Extend patch at least 2 inches in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.
F. Wall and Partition Penetration: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
G. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with a U.L. Listed firestopping or fire-resistant joint sealer.
H. Floor Penetrations: Terminate insulation underside of floor assembly and at floor support at top of floor.
I. Flanges, Fittings, and Valves - Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply pre-molded, precut, or field-fabricated segments of insulation around flanges, unions, valves, and fittings. Make joints tight. Bond with adhesive.
   1. Use same material and thickness as adjacent pipe insulation.
   2. Overlap nesting insulation by 2 inches or 1-pipe diameter, which ever is greater.
   3. Apply materials with adhesive, fill voids with mineral fiber insulating cement. Secure with wire or tape.
   4. Insulate elbows and tees smaller than 3 inches pipe size with pre-molded insulation.

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5. Insulate elbows and tees 3 inches and larger with pre-molded insulation or insulation material segments. Use at least 3 segments for each elbow.
6. Cover insulation, except for metal jacketed insulation, with PVC fitting covers and seal circumferential joints with butt strips.

J. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments."

3.04 BELOW GROUND PIPE INSULATION INSTALLATION

A. See individual piping sections.

3.05 GLASS FIBER PIPE INSULATION INSTALLATION

A. Bond insulation to pipe with lagging adhesive.
B. Seal exposed ends with lagging adhesive.
C. Seal seams and joints with vapor barrier compound.

3.06 FLEXIBLE ELASTOMERIC CELLULAR PIPE INSULATION INSTALLATION

A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.
B. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.
1. Miter cut materials to cover soldered elbows and tees.
2. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

3.07 JACKETS

A. Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2 inches laps at longitudinal joints and 3-inch wide butt strips at end joints.
1. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound (mastic) and glass tape (glassfab).

3.08 FINISHES

A. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed exterior insulation.

3.09 APPLICATIONS

A. General: Materials and thicknesses are specified in schedules at the end of this Section.
B. Piping Systems: Unless otherwise indicated, insulate the following piping systems:
1. Domestic cold water.
2. Domestic hot water.
3. Recirculated hot water.
4. Drains and sanitary P-traps receiving air conditioning condensate.

3.10 PIPE INSULATION SCHEDULES

A. General: Furnish insulation vapor barrier on all piping carrying fluids below 60ºF.
B. Schedules:
1. Domestic Cold, Hot and Recirculation Water (including makeup water piping):
a. Domestic Cold-Water Piping: 1" rigid fiberglass insulation with vapor barrier.

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b. Domestic Hot-Water and Recirculation Piping: 1" rigid fiberglass insulation for piping.
c. Domestic Water Piping in Concrete Block Walls: 3/4" flexible elastomeric insulation.
d. Underground Hot Water Piping: ¾" flexible elastomeric insulation.

END OF SECTION 220700

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SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY
A. Section Includes:
1. Piping and fittings.
2. Piping joining materials.
3. Transition fittings.
4. Dielectric fittings.

1.03 ACTION SUBMITTALS
A. Product Data: For transition fittings and dielectric fittings.

1.04 INFORMATIONAL SUBMITTALS
A. System purging and disinfecting activities report.
B. Field quality-control reports.

1.05 WARRANTY
A. Special Limited Warranty: For press-connect fitting and valves, include manufacturer's standard warranty for the following:
1. Warranty Period for Press-Connect Fittings: 50 years from date of Substantial Completion.
2. Warranty Period for Press-Connect Valves: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS
A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.02 COPPER TUBE AND FITTINGS
A. Hard Copper Tube: ASTM B88, Type L (ASTM B88M, Type B) water tube, drawn temper.
B. Soft Copper Tube: ASTM B88, Type K (ASTM B88M, Type A) water tube, annealed temper.
C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
E. Copper Unions:
1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

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F. Copper Press-Connect Fittings:
1. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following:
a. Apollo Flow Controls; Conbraco Industries, Inc., ApolloXpress.
b. NIBCO INC.
c. Viega LLC, Propress.
2. Fittings for NPS 2 (DN 50) and Smaller: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
4. NPS 2-1/2 thru NPS 4 (DN 65 to DN 100) Fittings: Stainless steel grip ring and EPDM O-ring seal in each end.
5. Press Ends: Un-pressed fitting identification feature to the fitting wall.
6. Sealing Element: EPDM.

2.03 PIPING JOINING MATERIALS
A. Pipe-Flange Gasket Materials:
1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.
B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
C. Solder Filler Metals: ASTM B32, lead-free alloys.
D. Flux: ASTM B813, water flushable.
E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP-5 Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.04 TRANSITION FITTINGS
A. General Requirements:
1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

2.05 DIELECTRIC FITTINGS
A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
B. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. A.Y. McDonald Mfg. Co.
b. Capitol Manufacturing Company.
c. Central Plastics Company.
d. HART Industrial Unions, LLC.
e. Jomar Valve.
f. Matco-Norca.
g. WATTS.
h. Wilkins.
i. Zurn Industries, LLC.
2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C.
4. End Connections: Solder-joint, or press-connect joint, copper alloy and threaded ferrous.

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C. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca.
d. WATTS.
e. Wilkins.
f. Zurn Industries, LLC.
2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C.
5. End Connections: Solder-joint, threaded, or press-connect, copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Elster Perfection Corporation.
b. Grinnell Mechanical Products.
c. Matco-Norca.
d. Precision Plumbing Products.
e. Victaulic Company.
2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F1545.
4. Pressure Rating and Temperature: 300 psig (2070 kPa) at 225 deg F (107 deg C)
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 – EXECUTION

3.01 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve and pressure gage inside the building at each domestic water-service entrance.

D. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping to permit valve servicing.

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I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
J. Install piping free of sags and bends.
K. Install fittings for changes in direction and branch connections.
L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
M. Install sleeves for piping penetrations of walls, ceilings, and floors.
N. Install sleeve seals for piping penetrations of concrete walls and slabs.
O. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.02 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    1. Apply appropriate tape or thread compound to external pipe threads.
    2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
F. Press-Connect Joints for Copper Tubing: Join copper tube and pressure-connect fittings with tools recommended by fitting manufacturer.
    1. Mark proper insertion depth prior to making press connection.
G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.03 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings or nipples.
C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100) Use dielectric flange kits.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
    1. Vertical Piping: MSS Type 8 or 42, clamps.
    2. Individual, Straight, Horizontal Piping Runs:
        a. MSS Type 1, adjustable, steel clevis hangers.
C. Support vertical piping and tubing at base and at each floor.
D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
    1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.

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2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

F. Install supports for vertical copper tubing every 10 feet (3 m).

3.05 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection.

3.06 IDENTIFICATION

A. Identify system piping and components.

B. Label pressure piping with system operating pressure.

3.07 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:
   a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in “Piping Tests” Subparagraph below and to ensure compliance with requirements.
   c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:
   a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

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c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.08 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
   b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.09 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:
      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
      2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   d. Repeat procedures if biological examination shows contamination.

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e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.10 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service piping, NPS 3 (DN 80) and smaller, shall be the following:

1. Soft copper tube, ASTM B88, Type K (ASTM B88M, Type A) wrought-copper, solder-joint fittings; and brazed copper press-connect fittings; and press-connect joints.

D. Aboveground domestic water piping, NPS 2 (DN 50) and smaller shall be the following:

1. Hard copper tube, ASTM B88, Type L (ASTM B88M, Type B) [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.
2. Hard copper tube, ASTM B88, Type L (ASTM B88M, Type B); copper press-connect fittings; and press-connect joints.

3.11 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

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SECTION 221119

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

A. This Section includes plumbing specialties for the following:
   1. Water distribution systems.
   2. Soil, waste, and vent systems.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
   1. Water Distribution Piping: 125 psig.
   2. Soil, Waste, and Vent Piping: 10-foot head of water.

1.04 SUBMITTALS

A. Product Data: For each plumbing specialty indicated. Include rated capacities of selected equipment and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:
   1. Thermostatic water mixing valves.
   2. Water hammer arresters.
   3. Drain trap seals.
   4. Hose bibbs and hydrants.
   5. Cleanouts.
   6. Floor drains.
   7. Vent terminals, and roof flashing assemblies.

B. Reports: Specified in "Field Quality Control" Article.

C. Maintenance Data: For specialties to include in the maintenance manuals. Include the following:
   1. Thermostatic water mixing valves.
   2. Hydrants.

1.05 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing specialties and are based on the specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered.

B. Provide listing/approval stamp, label, or other marking on plumbing specialties made to specified standards.

C. Listing and Labeling: Provide electrically operated plumbing specialties specified in this Section that are listed and labeled.
   1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.

D. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

E. Comply with NFPA 70, "National Electrical Code," for electrical components.

F. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.

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PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Thermostatic Water Mixing Valves:
   a. Appollo/Conbraco Industries, Inc.
   b. Bradley Corp.
   c. Lawler Manufacturing Co., Inc.
   d. Leonard Valve Co.
   e. Mark Controls Corp.; Powers Process Controls.
   f. Symmons Industries, Inc.
2. Wall Hydrants:
   a. Josam Co.
   b. Smith: Jay R. Smith Mfg. Co.
   c. Tyler Pipe; Wade Div.
   d. Watts Industries, Inc.; Water Products Div.
   e. Woodford Manufacturing Co.
   f. Zurn Industries, Inc.; Hydromechanics Div.
3. Water Hammer Arresters:
   a. Josam Co.
   b. Smith: Jay R. Smith Mfg. Co.
   c. Tyler Pipe; Wade Div.
   d. Watts Industries, Inc.;
   e. Zurn Industries, Inc.; Hydromechanics Div.
4. Drain Trap Seals:
   a. J. R. Smith; Quad Close
   b. Proset Trap Guard
   c. Rectorseal Sure Seal
   d. IPS Green Drain
5. Cleanouts:
   a. Josam Co.
   b. Mifab
   c. Smith: Jay R. Smith Mfg. Co.
   d. Tyler Pipe, Wade Div.
   e. Watts
   f. Zurn Industries, Inc., Hydromechanics Div.
6. Floor Drains:
   a. Josam Co.
   b. Mifab
   c. Smith: Jay R. Smith Mfg. Co.
   d. Tyler Pipe, Wade Div.
   e. Watts
   f. Zurn Industries, Inc., Hydromechanics Div.

2.02 THERMOSTATIC WATER MIXING VALVES

A. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and capacity at pressure loss as indicated.
   1. Bimetal Thermostat, Operation and Pressure Rating: 125 psig minimum.
   2. Liquid-Filled Motor, Operation and Pressure Rating: 100 psig minimum.

B. Thermostatic Water Mixing Valves: Unit, with the following:
   1. Piping, of sizes and in arrangement indicated. Include valves and unions.
   2. Piping Component Finish: Rough brass.
   3. Thermometer: Manufacturer's standard.

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2.03 HYDRANTS

A. Wall Hydrants: ASME A112.21.3M or ASSE 1019, non-freeze, automatic draining, anti-backflow type, key operation, with 3/4- or 1-inch NPS threaded or solder-joint inlet, and ASME B1.20.7 garden-hose threads on outlet. Include operating key for each hydrant.
   1. Type: Recessed.
   2. Finish: Nickel bronze.

B. Roof Hydrants: ASSE 1057, non-freeze, automatic draining with 3/4-inch inlet and garden hose outlet. Include roof flashing and under-deck flange.

2.04 DRAIN TRAP SEALS

A. Drain Trap Seals: Fitting installs in drain body outlets to block sewer gases.
   1. ASSE 1072 compliant.
   2. HDPE or DBS plastic frame with silicon or EDPM sealing gasket.

2.05 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arrestors: Provide water hammer arrestors where indicated on drawings. Unit shall be constructed of stainless-steel bellows arranged in a pressurized expansion chamber and shall have lifetime warranty. Units shall have P.D.I symbol that relates to fixture unit rating. Units shall be J.R. Smith 5000 Series AHydro-Trol.@ Equal products by Josam, Smith, Wade or Zurn will be acceptable.

B. Hose Bibbs: Bronze body, with renewable composition disc, 1/2- or 3/4-inch NPS threaded or solder-joint inlet. Provide ASME B1.20.7 garden-hose threads on outlet and integral or field-installed, nonremovable, drainable, hose-connection vacuum breaker.
   1. Finish: Rough brass.
   2. Operation: Operating-key (handle) type. Include operating key.

C. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-

2.06 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Use: 4 lb/sq. ft. or 0.0625-inch thickness.
   2. Vent Pipe Flashing: 3 lb/sq. ft. or 0.0469-inch thickness.
   3. Burning: 6 lb/sq. ft. or 0.0937-inch thickness.

B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

C. Fasteners: Metal compatible with material and substrate being fastened.

D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

E. Solder: ASTM B 32, lead-free alloy.

F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.07 CLEANOUT

A. Cleanout: Where plumbing specialties of this designation are indicated, provide products complying with the following and with the Fixture Schedule on the drawings.
   1. Applicable Standard: ASME A112.36.2M. ASME A112.3.1.

2.08 FLOOR DRAIN

A. Floor Drain: Where plumbing specialties of this designation are indicated, provide products complying with the following and with Fixture Schedule on drawings:
   1. Applicable Standard: ASME A112.21.1M. ASME A112.21.1M floor drain with ASME A112.14.1 backwater valve. ASME A112.3.1.

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PART 3 - EXECUTION

3.01 PLUMBING SPECIALTY INSTALLATION

A. General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.

B. Install hose bibbs with integral or field-installed vacuum breaker.

C. Install wall hydrants with integral or field-installed vacuum breaker.

D. Install drain trap seals in drain body outlets as noted.

E. Install cleanouts in aboveground piping and building drain piping as indicated, and where not indicated, according to the following:

1. Size same as drainage piping up to 4-inch NPS. Use 4-inch NPS for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping 3-inch NPS and smaller and 80 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

F. Install cleanout deck plates, of types indicated, with top flush with finished floor, for floor cleanouts for piping below floors.

G. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

H. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

I. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

J. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor or as indicated. Size outlets as indicated.

K. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed.

L. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

M. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

N. Position floor drains for easy access and maintenance.

O. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

P. Fasten recessed, wall-mounting plumbing specialties to reinforcement built into walls.

Q. Secure supplies to supports or substrate.

R. Install individual stop valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated.

S. Install water-supply stop valves in accessible locations.

T. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

U. Locate drainage piping as close as possible to bottom of floor slab supporting fixtures and drains.

V. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

W. Include wood-blocking reinforcement for recessed and wall-mounting plumbing specialties.

X. Anchor roof hydrants to roof deck. Anchor in accordance with manufacturer’s instructions. Coordinate flashing with roofing installer.

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3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
   1. Install piping connections between plumbing specialties and piping specified in other Division 22 sections.
   2. Install piping connections indicated between appliances and equipment specified in other Sections; connect directly to plumbing piping systems.
   3. Install piping connections indicated as indirect wastes from appliances and equipment specified in other Sections, to spill over receptors connected to plumbing piping systems.

B. Install hoses between plumbing specialties and appliances as required for connections.

C. Supply Runouts to Plumbing Specialties: Install hot- and cold-water-supply piping of sizes indicated, but not smaller than required by authorities having jurisdiction.

D. Drainage Runouts to Plumbing Specialties: Install drainage and vent piping, with approved trap, of sizes indicated, but not smaller than required by authorities having jurisdiction.

3.03 FLASHING INSTALLATION

A. Fabricate flashing manufactured from single piece unless large pans, sumps, or other drainage shapes are required.

B. Burn joints of lead sheets where required.

C. Solder joints of copper sheets where required.

D. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

E. Set flashing on floors and roofs in solid coating of bituminous cement.

F. Secure flashing into sleeve and specialty clamping ring or device.

G. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings.

H. Fabricate and install flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection if indicated.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of factory-authorized service representative to supervise the field assembly of components and installation of grease recovery units, including piping and electrical connections, and to report results in writing.
   1. Test and adjust plumbing specialty controls and safeties. Replace damaged and malfunctioning controls and components.

3.05 COMMISSIONING

A. Before startup, perform the following checks:
   1. System tests are complete.
   2. Damaged and defective specialties and accessories have been replaced or repaired.
   3. Clear space is provided for servicing specialties.

B. Before operating systems, perform the following steps:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open general-duty valves to fully open position.

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3. Remove and clean strainers.
4. Verify that drainage and vent piping are clear of obstructions. Flush with water until clear.

C. Startup Procedures: Follow manufacturer's written instructions. If no procedures are prescribed by manufacturer, proceed as follows:
1. Energize circuits for electrically operated units. Start and run units through complete sequence of operations.

D. Adjust operation and correct deficiencies discovered during commissioning.

3.06 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221119

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SECTION 221316

DRAINAGE AND VENT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY
A. This Section includes sanitary drainage and vent piping inside building and to locations indicated.
B. Related Sections include the following:
1. Division 22 Sections for drainage and vent piping system specialties.

1.03 DEFINITIONS
A. Sewerage Piping: Building sewer piping outside building that conveys sanitary sewage from building.
B. Drainage Piping: Building sewer piping outside building that conveys storm drainage from building.
C. Service Entrance Piping: Drainage piping at entry into building between outside building sewer piping and inside drainage piping.
D. Drainage and Vent Piping: Piping inside building that conveys waste water and vapors from fixtures and equipment throughout the building.
E. The following are industry abbreviations for plastic and other piping materials:
1. PVC: Polyvinyl chloride.
F. Underground Piping: Piping located below slab or grade and to within 6-inches above slab or grade.

1.04 SYSTEM PERFORMANCE REQUIREMENTS
A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
1. Soil, Waste, and Vent Systems: 10-foot head of water.

1.05 SUBMITTALS
A. Test Results and Reports: Specified in "Field Quality Control" Article.

1.06 QUALITY ASSURANCE
A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.
B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.01 PIPES AND TUBES
A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.
B. PVC Plastic Pipe: ASTM D 2665, Schedule 40.

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2.02 PIPE AND TUBE FITTINGS

A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.
B. Threaded-Fitting, End Connections: ASME B1.20.1.
C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311 drain, waste, and vent pipe patterns.

2.03 JOINING MATERIALS

A. General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.
B. Refer to Division 22 Section for commonly used joining materials.
C. Couplings: Assemblies with combination of clamps, gaskets, sleeves, and threaded or flanged parts; made by piping system manufacturer for joining system piping.
D. Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

PART 3 – EXECUTION

3.01 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.
B. Flanges may be used on aboveground piping, unless otherwise indicated.
C. Soil, Waste, and Vent Piping: Use the following:
   1. 12-Inch NPS or smaller: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.

3.02 PIPING INSTALLATION, GENERAL

A. Refer to Division 22 Section for basic piping installation.

3.03 SERVICE ENTRANCE PIPING INSTALLATION

A. Extend building sanitary drain piping and connect to sanitary sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building sanitary drains with building sanitary sewers.
B. Install sleeve at each service entrance pipe penetration through foundation wall. Refer to Division 22 Section for sleeves.

3.04 DRAINAGE AND VENT PIPING INSTALLATION

A. Make changes in direction for drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not make change in direction of flow greater than 90 degrees. Use proper size of standard increasers and reducers if different sizes of piping are connected. Reducing size of drainage piping in direction of flow is prohibited.
B. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

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C. Install drainage and vent piping at the following minimum slopes, unless otherwise indicated:
   1. Sanitary Building Drain: 2 percent downward in direction of flow for piping 3-inch NPS and smaller; 1 percent downward in direction of flow for piping 4-inch NPS and larger.
   2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
D. Install PVC plastic drainage piping according to ASTM D 2665.
E. Install underground PVC plastic drainage piping according to ASTM D 2321.

3.05 JOINT CONSTRUCTION
A. Refer to other Division 22 sections for basic piping joint construction.
B. PVC Piping Joints: Join drainage piping according to ASTM D 2665.
C. ABS to PVC Piping Transition Joints: Make non-pressure transition joints between ABS and PVC drainage components, using fittings and procedure according to ASTM D 3138.
D. Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F 402 for safe handling during joining of plastic pipe and fittings.

3.06 HANGER AND SUPPORT INSTALLATION
A. Refer to Division 22 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
   1. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
   2. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100.
B. Install supports according to Division 22 Section "Hangers and Supports."
C. Support vertical piping and tubing at base and at each floor.
D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
E. Install hangers for PVC plastic piping with the following maximum spacing and minimum rod diameters:
   1. 1-1/2- and 2-Inch NPS: Maximum horizontal spacing, 48 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 48 inches.
   2. 4- and 5-Inch NPS: Maximum horizontal spacing, 48 inches with 5/8-inch minimum rod diameter; maximum vertical spacing, 48 inches.
   3. 6-Inch NPS: Maximum horizontal spacing, 48 inches with 3/4-inch minimum rod diameter; maximum vertical spacing, 48 inches.
F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.07 CONNECTIONS
A. Connect service entrance piping to exterior sewerage and drainage piping. Use transition fitting to join dissimilar piping materials.
B. Connect drainage piping to service entrance piping, and extend to and connect to the following:
   1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
   3. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections 2-1/2-inch NPS and larger.

3.08 ACCESSORIES INSTALLATION:
A. Install accessories according to manufacturer’s written instructions and as indicated.

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3.09 FIELD QUALITY CONTROL

A. Inspect drainage and vent piping as follows:
   1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
      a. Roughing-In Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
   3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
   4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
   3. Roughing-In Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 feet of head. Water level must not drop from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.
   4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gas tight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
   5. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
   6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTING

A. Clean interior of piping system. Remove dirt and debris as work progresses.
B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
C. Place plugs in ends of uncompleted piping at end of day and when work stops.
D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of water-based latex paint.

END OF SECTION 221316

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SECTION 223300

ELECTRIC WATER HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

A. This Section includes electric water heaters and accessories.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.

B. Product Data including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories. Indicate dimensions, finishes and coatings, required clearances, methods of assembly of components, and piping and wiring connections.

C. Shop Drawings showing layout of each unit, including tanks, pumps, controls, related accessories, and piping.

D. Setting Drawings with templates and directions for installing foundation bolts, anchor bolts, and other anchorages.

E. Wiring diagrams from manufacturers detailing electrical requirements for electrical power supply wiring to water heaters. Include ladder-type wiring diagrams for interlock and control wiring required for final installation of water heaters and controls. Differentiate between factory-installed and field-installed wiring.

F. Product certificates signed by manufacturers of water heaters certifying that their products comply with specified requirements.

G. Certificates of shop inspection and data report as required by provisions of ASME Boiler and Pressure Vessel Code, when ASME construction is indicated.

H. Field quality-control installation reports.

I. Maintenance data for water heaters to include in operation and maintenance manuals. Include startup instructions.

1.04 QUALITY ASSURANCE

A. ASHRAE Standard: Comply with performance efficiencies prescribed in ASHRAE 90.1, "Energy Efficient Design of New Buildings."

B. NFPA Standard: Comply with NFPA 70, "National Electrical Code," for electrical components.

C. Listing and Labeling: Provide electrically operated water heaters, controls, and components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.

D. Product Options: Drawings indicate size, profiles, connections, dimensional requirements, and characteristics of water heaters and accessories and are based on specific types and models indicated. Other manufacturers' water heaters and accessories with equal performance characteristics may be considered.

1.05 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

B. Warranty Period: 3 years after date of Material Completion.

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PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Point-of-Use, Tankless, Electric Water Heaters:

a. Bradford White

b. Chronomite Laboratories, Inc.

c. Eemax, Inc.

2.02 WATER HEATERS, GENERAL

A. Specified manufacturer's standard components and features are acceptable where specific product requirements are not indicated.

B. Temperature Control: Adjustable thermostat, except for units where other arrangement is indicated or temperature is regulated by flow-control fitting.

C. Safety Control: Automatic, high-temperature-limit cutoff device or system on commercial units and where indicated. Include automatic low-water cutoff device or system on commercial units where indicated.

D. Interior Finish: Materials that comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.

E. Tappings: Factory fabricated of materials compatible with tank. Include tappings for piping connections, relief valves, pressure gage, thermometer, blow down, and controls as required and others as indicated. Attach tappings to tank before testing and labeling. Include tappings and connections as follows:

1. 2-Inch NPS and Smaller: Threaded ends.

F. Insulation: Fiberglass, polyurethane foam, or manufacturer's standard that is suitable for operating temperature and required insulating value. Include insulation material that surrounds entire tank except connections and controls.

G. Jacket: Steel, with baked-on enamel finish, except where otherwise specified.

H. Anode Rods: Factory installed, magnesium.

I. Combination Temperature and Pressure Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

1. Exception: Omit relief valve for tankless water heater. Include pressure relief valve for installation in piping.

2.03 POINT-OF-USE, TANKLESS, ELECTRIC WATER HEATERS

A. Description: Point-of-use, tankless, electric water heater conforming to applicable requirements of UL 499.

B. Construction: Manufacturer's standard and without hot-water storage.

C. Working-Pressure Rating: 150 psig.

D. Electric Heating System: Manufacturer's standard electric-resistance type.

E. Jacket: Aluminum or steel with baked-on enamel finish, or plastic.

F. Mounting: Bracket or device for wall mounting.

G. Temperature Control: Flow-control fitting in inlet piping.

H. Safety Control: Automatic, high-temperature-limit cutoff.

PART 3 - EXECUTION

3.01 WATER HEATER INSTALLATION

A. General: Install water heaters on concrete bases. Set and connect units according to manufacturer's written instructions. Install units plumb, level, and firmly anchored in locations indicated. Maintain manufacturer's recommended clearances. Install so controls and devices are accessible for service.

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B. Install pressure relief valves in hot-water-outlet piping for water heaters without storage. Extend relief valve outlet with water piping in continuous downward pitch and discharge to closest floor drain.
C. Install piping adjacent to water heaters to allow service and maintenance.
D. Arrange for field-applied insulation on equipment and piping not furnished with factory-applied insulation.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
   1. Connect hot- and cold-water piping to units with shutoff valves and unions. Connect hot-water circulating piping to unit with shutoff valve, check valve, and union.
   2. Make connections with dielectric fittings where piping is made of dissimilar metals. Dielectric fittings are specified in Division 22 Sections.
B. Electrical Connections: Power wiring and disconnect switches are specified in Division 26 Sections. Arrange wiring to allow unit servicing.
C. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 COMMISSIONING

A. Perform the following final checks before startup:
   1. Fill water heaters with water.
   2. Check that piping system tests are complete.
   3. Check for piping connection leaks.
   4. Check for clear relief valve inlets, outlets, and drain piping.
   5. Test operation of safety controls, relief valves, and devices.
B. Perform the following startup procedures:
   1. Energize electric circuits.
   2. Adjust operating controls.
   3. Adjust hot-water-outlet temperature settings.

END OF SECTION 223300

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SECTION 224000

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

A. This Section includes plumbing fixtures and trim, faucets, other fittings, and related components.

1.03 DEFINITIONS

A. Accessible: Plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped, disabled, and elderly people.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, traps and waste pipes. Pipe fittings, tube fittings, and general-duty valves are included where indicated.

1.04 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.

B. Product Data for each plumbing fixture category and type specified. Include selected fixture, trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

C. Wiring diagrams from manufacturer for electrically operated units.

D. Maintenance data for plumbing fixtures and components to include in the operation and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category from one source and by a single manufacturer.

1. Exception: Where fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for this category.

B. Regulatory Requirements: Comply with requirements of 2010 ADA Standards for Accessible Design; regarding plumbing fixtures for physically handicapped people.

C. Energy Policy Act Requirements: Comply with requirements of Public Law 102-486, "Energy Policy Act," regarding water flow rate and water consumption of plumbing fixtures.

D. Listing and Labeling: Provide electrically operated fixtures and components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing fixtures and are based on specific types and models indicated. Other manufacturers' fixtures with equal performance characteristics may be considered.

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1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver plumbing fixtures in manufacturer's protective packing, crating, and covering.

B. Store plumbing fixtures on elevated platforms in dry location.

1.07 PROJECT CONDITIONS

A. Field Measurements: Coordinate roughing-in and final fixture locations and verify that plumbing fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.01 PLUMBING FIXTURE STANDARDS

A. Comply with applicable standards below and other requirements specified.

1. Electric Water Coolers: ARI 1010 and UL 399.
2. Vitreous-China Fixtures: ASME A112.19.2M.

2.02 LAVATORY/SINK FAUCET STANDARDS

A. Comply with ASME A112.18.1M and other requirements specified for lavatory, sink, and similar-type-fixture faucet fittings. Include hot- and cold-water indicators; 2.0-gpm-maximum flow rate; and polished, chrome-plated finish; except where otherwise indicated. Coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

1. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
2. Faucet Hose: ASTM D 3901.
3. Hose-Connection Vacuum Breakers: ASSE 1011.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
6. Pipe Threads: ASME B1.20.1.
7. Sensor-Actuated Faucets and Electrical Devices: UL 1951.

2.03 MISCELLANEOUS FITTING STANDARDS

A. Comply with ASME A112.18.1M and other requirements specified for fittings, other than faucets. Include polished, chrome-plated finish, except where otherwise indicated. Coordinate fittings with other components and connectors.

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Automatic Flow Restrictors: ASSE 1028.
3. Brass and Copper, Supplies and Tubular Brass: ASME A112.18.1M.
4. Fixed Flow Restrictors: ASSE 1034.
5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

2.04 MISCELLANEOUS COMPONENT STANDARDS

A. Comply with applicable standards below and other requirements specified for components for plumbing fixtures, equipment, and appliances.

1. Hose-Coupling Threads: ASME B1.20.7.
2. Pipe Threads: ASME B1.20.1.
3. Plastic Toilet Seats: ANSI Z124.5.
4. Supply and Drain Insulation Kits: CABO A117.1.

2.05 FITTINGS

A. Supplies:

1. Manufacturers and Models:
   a. A. Y. McDonald 2082 Series
   b. B&K 490 Series
   c. Brasscraft KTCS Series

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d. McGuire BV Series
e. Watts 894 Series
f. Zurn 8800 Series

2. Supply Inlet: Brass pipe or copper tube, size required for final connection.
3. Supply Stops: Chrome-plated brass, angle; chrome-plated brass ball; quarter-turn operation; ½" compression inlet and 3/8" o.d. compression outlet; same size as supply inlet and with outlet matching supply riser, chrome handle.
4. Supply Risers: 3/8" NPS flexible copper tube with knob end. Use chrome-plated tube for exposed applications.

B. Traps and Wastes:
1. Manufacturers:
a. McGuire
b. EBC
c. Dearborne
d. Watts
e. Zurn
2. Traps: Tubular brass with 0.045" (17 ga.) Wall thickness, slip-joint inlet, cleanout, wall flange, escutcheons, and size to match equipment. Use chrome-plated tube for exposed applications.
3. Continuous Waste: Tubular brass, 0.045" (17 ga.) Wall thickness, with slip-joint inlet, and size to match equipment.
4. Indirect Waste: Hard copper DWV tube and solder joint fittings; size to match equipment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for potable, hot- and cold-water supply piping systems; soil, waste, and vent piping systems; and supports. Verify that locations and sizes of piping and locations and types of supports match those indicated, before installing and connecting fixtures. Use manufacturer's roughing-in data when roughing-in data are not indicated.
B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Include supports for plumbing fixtures according to the following:
1. Reinforcement: For floor-mounted lavatories and sinks that require securing to wall and recessed, box-mounted, electric water coolers.
2. Fabricate reinforcement from 2-by-4-inch or 2-by-6-inch fire-retardant-treated-wood blocking between studs or 1/4-by-6-inch steel plates attached to studs, in wall construction, to secure fixtures to wall. Include length that will extend beyond ends of fixture mounting bracket and attach to at least 2 studs.

B. Include fitting insulation kits for accessible fixtures according to the following:
1. Lavatories: Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall.
2. Sinks: Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall.
3. Fixtures with Offset Drain: Cover hot- and cold-water supplies, offset drain, trap, and waste to wall.
4. Other Fixtures: Cover exposed fittings below fixture.

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3.03 PLUMBING FIXTURE INSTALLATION

A. Assemble plumbing fixtures and trim, fittings, faucets, and other components according to manufacturers' written instructions.

B. Install fixtures level and plumb according to manufacturers' written instructions, roughing-in drawings, and referenced standards.

C. Install floor-mounted, floor-outlet water closets with fittings and gasket seals.

D. Install toilet seats on water closets.

E. Install wall-hanging, back-outlet urinals with gasket seals.

F. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for handicapped people to reach.

G. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated.

H. Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.

I. Fasten recessed, wall-mounted fittings to reinforcement built into walls.

J. Fasten wall-mounted fittings to reinforcement built into walls.

K. Fasten counter-mounting plumbing fixtures to casework.

L. Secure supplies to supports or substrate within pipe space behind fixture.

M. Set mop basins in leveling bed of cement grout.

N. Install individual stop valve in each water supply to fixture. Use gate or globe valve where specific stop valve is not specified.

O. Install water-supply stop valves in accessible locations.

P. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.

Q. Install shower, flow-control fittings with specified maximum flow rates in shower arms.

R. Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes, except where otherwise indicated.

S. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.

T. Seal joints between fixtures and walls, floors, and counters using sanitary-type, 1-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.04 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other Division 22 Sections.

B. Supply and Waste Connections to Plumbing Fixtures: Refer to plumbing fixture schedules at the end of this Section for fitting sizes and connection requirements for each plumbing fixture.

C. Supply and Waste Connections to Equipment Specified in Other Sections: Connect equipment with supply inlets, supply stops, supply risers, and traps specified in this Section. Use fitting sizes required to match connected equipment. Connect fittings to plumbing piping.

D. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Arrange for electric-power connections to fixtures and devices that require power. Electric power is specified in Division 26 Sections.

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3.05 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.
B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
C. Inspect installed fixtures for damage. Replace damaged fixtures and components.
D. Test installed fixtures after water systems are pressurized and demonstrate proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.06 ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
B. Adjust water pressure at drinking fountains, electric water coolers, faucets, shower valves, and flushometer valves having controls, to produce proper flow and stream.
C. Replace washers and seals of leaking and dripping faucets and stops.
D. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Include the following:
    1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
    2. Remove sediment and debris from drains.

3.07 PROTECTION

A. Provide protective covering for installed fixtures and fittings.
B. Do not allow use of fixtures for temporary facilities, except when approved in writing by Owner.

3.08 WATER CLOSET SCHEDULE - FLUSH VALVE TYPE

A. Water Closet: Where plumbing fixtures of this designation are indicated, provide products complying with the following and with the Plumbing Fixture Schedule on the drawings:
    1. Products: Subject to compliance with requirements, provide one of the following:
    2. Vitreous-China Water Closet:
        a. American Standard, Inc.
        b. Kohler Co.
        c. Sloan Valve Co.
        d. Zurn Plumbing Products
    3. Flushometer Valve:
        a. American Standard, Inc.
        b. Sloan Valve Co.
        c. Zurn Plumbing Products
    4. Toilet Seat:
        a. Bemis Mfg. Co.
        b. Centoco Manufacturing Corp.
        c. Church Seat Co.
        d. Olsonite Corp.
        e. Sanderson Plumbing Products, Inc.;
        f. Sperzel.
        g. Zurn Plumbing Products
    5. Flushometer Valve Operation: Diaphragm.
    6. Flushometer Valve Finish: Polished, chrome-plated, exposed metal parts.
    7. Flushometer Valve, Water Consumption: Factory set 1.28 gal. maximum per flushing cycle.

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8. Flushometer valve components include the following:
   a. Brass, lever-handle actuation.
   b. Nonhold-open feature.
9. Toilet Seat: Solid-plastic, water-closet seat with bumpers and hardware, compatible with water closet and as follows:
   a. Class: Commercial, Extra-Heavy-Duty type, exceeding requirements of Commercial, Standard class.
   b. Size: Elongated.
   c. Hinge Type: Self-sustaining check (SC).
10. Water Closet Floor Flange: PVC closet flange with adjustable slotted metal ring.

3.09 URINAL SCHEDULE

A. Urinal: Where plumbing fixtures of this designation are indicated, provide products complying with the following and with the Plumbing Fixture Schedule on the drawings:
   1. Products: Subject to compliance with requirements, provide one of the following:
   2. Vitreous-China Urinal:
      a. American Standard, Inc.
      b. Kohler Co.
      c. Sloan Valve Co.
      d. Zurn Plumbing Products
   3. Flushometer Valve:
      a. American Standard, Inc.
      b. Sloan Valve Co.
      c. Zurn Plumbing Products
   4. Flushometer Valve Construction: Cast-brass body, brass or copper pipe or tubing inlet with wall flange and tailpiece with spud, screwdriver check stop, and vacuum breaker.
   5. Flushometer Valve Operation: Diaphragm.
   6. Flushometer Valve Finish: Polished, chrome-plated, exposed metal parts.
   7. Flushometer Valve, Water Consumption: Factory set 0.5 gal. maximum per flushing cycle.
   8. Flushometer valve components include the following:
      a. Brass, lever-handle actuation.
      b. Nonhold-open feature..
   9. Fixture Support: Type I, vertically adjustable, urinal, chair carrier with coupling; heavy-duty, rectangular-steel, upright members; bearing plate; and feet.

3.10 LAVATORY SCHEDULE

A. Lavatory: Where plumbing fixtures of this designation are indicated, provide products complying with the following and with the Plumbing Fixture Schedule on the drawings:
   1. Products: Subject to compliance with requirements, provide one of the following:
   2. Vitreous-China Lavatory:
      a. American Standard, Inc.
      b. Kohler Co.
      c. Sloan Valve Co.
      d. Zurn Plumbing Products

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3. Faucet:
   a. American Standard, Inc.
   b. Chicago Faucet Co.
   c. Kohler Co.
   d. T & S Brass and Bronze Works, Inc.
   e. Zurn Industries
4. Fitting Insulation Kit:
   a. TRUEBRO, Inc.
   b. McGuire
   c. Brocar
5. Supplies: See Fittings section of this specification.
6. Faucet Construction: Cast brass with ceramic cartridges and polished chrome finish.
7. Faucet Water Consumption: 1.5 or 0.5 gpm as specified on drawings.
8. Supply Insulation Kit: Molded, soft-plastic covering for supplies from wall to fixture with removable covering for stops and handles. Include manufacturer's standard fasteners, straps, and adhesives.
9. Drain Insulation Kit: Molded, soft-plastic covering for drain piping from fixture to wall. Include manufacturer's standard fasteners, straps, and adhesives.
10. Fixture Support: Type II, concealed arm; vertically adjustable, lavatory, chair carrier with heavy-duty, rectangular-steel, upright members; and feet.

3.11 SINK SCHEDULE

A. Accessible: Where plumbing fixtures of this designation are indicated, provide products complying with the following and with the Plumbing Fixture Schedule on the Drawings:
1. Products: Subject to compliance with requirements, provide one of the following:
2. Stainless-Steel Sink:
   a. Elkay Manufacturing Co.
   b. Just Manufacturing Co.
   c. Advance Tabco
3. Faucet:
   a. American Standard, Inc.
   b. Chicago Faucet Co.
   c. Delta Commercial Faucet
   d. Kohler Co.
   e. T & S Brass and Bronze Works, Inc.
   f. Zurn Industries
4. Fitting Insulation Kit:
   a. TRUEBRO, Inc.
   b. McGuire
   c. Brocar
5. Fixture Stainless-Steel Thickness: 18 gauge.
6. Fixture Mounting: Counter, self-rimming.
7. Faucet Construction: See Fixture Schedule for faucet styles.
8. Faucet Water Consumption: 2.0 gpm maximum flow.
9. Drain{s}: 1-1/2-inch removable, stainless-steel strainer bucket with 3-1/2-inch removable, stainless-steel crumb cup with 1-1/2-inch NPS tubular-brass tailpiece.
10. Supplies: See Fittings section of this specification.

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3.12 MOP-SERVICE BASIN SCHEDULE

A. Mop-Service Basin: Where plumbing fixtures of this designation are indicated, provide products complying with the following and with the Plumbing Fixture Schedule on the drawings:

1. Products: Subject to compliance with requirements, provide one of the following:
2. Terrazzo Mop-Service Basin:
   a. Fiat Products, Inc.
   b. Forestone
   c. Stern-Williams Co., Inc.
3. Faucet:
   a. American Standard, Inc.
   b. Chicago Faucet Co.
   c. Speakman Co.
   d. T & S Brass and Bronze Works, Inc.
   e. Zurn Industries
4. Fixture Dimensions: See Plumbing Fixture Schedule on drawings.
5. Mounting: Floor.
6. Rim Guard: Manufacturer's standard.
7. Faucet: Widespread, cast brass with supplies on 8-inch centers.
8. Faucet Mounting: Wall, centered on fixture.
9. Faucet Components: Include the following:
   a. Finish: Rough chrome.
   b. Handles: Dual lever or 4 arm.
   c. Supply Stops: Integral, in shanks.
   d. Spout: With integral vacuum breaker, pail hook, and hose-thread outlet.
   e. Wall Brace: Assembly with wall bracket and support to faucet spout.
   f. Hose: 30-inch-minimum, flexible hose with stainless-steel hose wall bracket.
10. Drain: 3-inch NPS with grid strainer.
11. P-Trap: 3-inch NPS drainage piping.
12. Supplies: 1/2-inch NPS copper tubing with supply stop.
13. Reinforcement: Provide for wall-mounting faucet, wall brace, and hose-hook bracket.

3.13 ELECTRIC WATER COOLER SCHEDULE

A. Electric Water Cooler: Where plumbing fixtures of this designation are indicated, provide products complying with the following and with the Plumbing Fixture Schedule on the drawings:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Acorn Aqua; Acorn Mfg. Co.
   b. Elkay Manufacturing Co.
   c. Halsey Taylor.
   d. Haws Drinking Faucet Co.
   e. Oasis
2. Fixture Type: Bubbler.
3. No. of Bubblers or Stations: One.
4. Fixture Cabinet Material: Stainless steel.
5. Fixture Mounting: Wall.
6. Wall Grille: Stainless steel.
7. Supply: 3/8-inch NPS copper tubing with supply stop.

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3.14 KITCHEN EQUIPMENT FURNISHED BY OTHER DIVISION

A. Kitchen Fixture Equipment: Where plumbing fixtures of this designation are indicated and provide products complying with the following and with the drawings:

1. Products: Subject to compliance with requirements, provide one of the following:
2. Supply Inlet: 1/2-inch NPS
3. Supply Stop: Globe or ball valve.
4. Supply Riser: Rigid copper supply, size as determined by equipment inlet.
5. Drain: Connect to equipment drain outlet and route drain piping to drain receptor. Use DWV copper piping and fittings. Make indirect connection at drain receptor unless noted otherwise.

END OF SECTION 224000

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SECTION 230000

GENERAL HVAC PROVISIONS

PART 1 - GENERAL

1.01 Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

A. This Section includes general provisions covering the contract documents for HVAC Systems.

1.03 DEFINITIONS

A. Provide shall mean "Furnish, install and connect."

B. Piping shall mean "pipe installed with all specified fittings, valves and accessories, and forming a complete system."

C. HVAC shall mean "Heating, Ventilation and Air Conditioning."

1.04 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.

B. Electrical Coordination: In addition to submittal requirements of other Division 23 Sections, submit a document approved by the project Electrical Contractor certifying that all mechanical equipment being furnished under Division 23 complies with the electrical characteristics of the source power which will be furnished under Division 26.

C. Model numbers listed on the Mechanical Contract Documents shall not be construed to indicate electrical characteristics. Electrical characteristics of mechanical equipment shall be as indicated on the Electrical Contract Documents (Division 26).

D. Review of Submittals does not relieve the Contractor of any of the requirements of the Contract Documents. Failure by the Engineer to document errors and omissions in the Contractor's submittals during the Engineer's submittal review does not constitute a waiver of any of the requirements of the original Contract Documents.

1.05 CONTRACTOR QUALIFICATIONS

A. HVAC Subcontractor shall have a current Class II Conditioned Air Contractors License for the state in which the project is being constructed. The Subcontractor shall have as part of the Firm a Service Department qualified to service all systems installed in the project or have a written agreement with a Service Agency qualified to provide such service. The Service Department or Agency shall be on call at all hours. The subcontractor shall have installed at least (within the last five years):

1. Three (3) hydronic water systems of at least 150-tons in size.
2. One heat recovery variable refrigerant flow system of at least 20-tons in size.

1.06 PRIOR APPROVALS

A. Manufacturers References: When reference is made in the Contract Documents to trade names or specific manufacturers and/or models, such reference, unless noted otherwise, is made to designate and identify the quality of materials or equipment to be furnished and is not intended to restrict competitive bidding. If it is desired to use materials or equipment different from those indicated on the Contract Documents, written request for approval must reach the hands of the Design Professional at least TEN DAYS prior to the date set for the opening of

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bids. A copy of the request should also be sent directly to the Engineer. Requests for prior approval of a proposed substitute shall be accompanied by complete technical data supporting the request.

B. Request for Prior Approval by facsimile transmission (fax) or email will not be considered. Prior approval requests shall be submitted in hard copy format only.

1.07 LAYOUT AND COORDINATION

A. Layout Basis:

1. The equipment listed on the Drawings and in the Specifications has been used for the physical arrangement of the mechanical systems. When equipment listed as acceptable, equal or equipment which has received "prior approval" is used, it shall be the Contractor's responsibility to provide structural, ductwork, electrical, service clearances, or other changes required to accommodate the substituted equipment. Changes shall be made at no additional cost to the Owner. Submit a list of required changes along with all prior approval requests and shop drawing submittals.
2. The Contract Drawings are intended to show the general arrangement of all mechanical work. They do not show in detail all offsets, fittings and transitions. Examine Drawings, investigate site conditions to be encountered and arrange work accordingly. Furnish all offsets and transitions required.
3. Drawings do not indicate in detail exact configuration of connections for fixtures, equipment and accessories. Final connection shall be as shown on approved Manufacturer's Submittal Drawings. Where Manufacturer's Submittal Drawings conflict with the Contract Documents, confer with the Design Professional for resolution.
4. Measurement of Drawings by scale shall not be used as dimensions for fabrication. Measurements for locating fixtures, equipment, ductwork, piping and other mechanical items shall be made on the site and shall be based on actual job conditions.
5. Check space limitations and verify electrical requirements before ordering any mechanical equipment or materials. Place large equipment inside the building prior to the erection of exterior walls where equipment cannot enter finished building openings.

B. Coordination: Mechanical work shall be coordinated with that of other trades to avoid conflict. The Contractor shall study all plans and specifications for this project and shall notify the Design Professional of any conflict between work under Division 23 and work under other divisions of the Project. Particular attention shall be given to interference between piping, electrical installations, structural systems, building openings and ductwork.

C. Installation Instructions: Two binders containing manufacturer's installation instructions for all equipment furnished under Division 23 shall be furnished by the Contractor. One binder shall be kept in the General Contractor's office at the job site. The other binder shall be delivered to the Engineer upon acceptance by the Design Professional of the Submittals.

D. Operation and Maintenance Instructions: Three copies of equipment O&M manuals contained in rigid 3-ring binders shall be submitted to the Owner a minimum of 15 days prior to equipment/systems training. Binders shall have permanent labels on the spine and front cover indicating project name, project number, building name and contents. Model and serial numbers of equipment shall be shown on the cover of their respective O&M manual(s).

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1.08 PERMITS

A. Obtain all necessary Permits and Inspections required for the installation of this work and pay all charges incident thereto. Deliver to the Design Professional all certificates of inspection issued by authorities having jurisdiction.

B. Sewer tap fees, water tap fees, meter fees, Dept. of Labor Fees for Boilers and Pressure Vessels and all other charges for work under Division 23, including charges for meter installation and excess service by the Gas Company or any other utilities shall be paid by the Contractor.

1.09 SAFETY

A. OSHA Requirements applicable to the project shall be complied with at all times.

B. Manufacturer's Safety Instructions shall be followed in all instances.

C. Asbestos Containing Materials (ACM) shall not be used on this project.

D. Refrigerants containing CFC's or HCFS's shall not be used on this project, nor shall any equipment using such refrigerants be incorporated into this project.

E. Electrical Equipment Clearances: Piping, equipment and other mechanical installations shall not be located within 42" of the front or 36" of the side of any electrical switchboards, panelboards, power panels, motor control centers, electrical transformers or similar electrical equipment. Piping and ductwork shall not pass through or above electrical equipment rooms except as required to serve those rooms.

F. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof or grade below. The guard shall extend not less than 30 inches beyond each end of such appliances, equipment, fans, components and roof hatch openings and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21 inch diameter sphere and shall comply with the loading requirements for guards specified in the International Building Code.

1.10 PROTECTION OF MECHANICAL SYSTEMS AND COMPONENTS DURING CONSTRUCTION

A. Material storage

1. All materials and equipment stored on the jobsite shall be elevated above the ground and stored under suitable weather cover. Materials and equipment shall not be situated in areas subjected to localized flooding.

2. Manufacturer's original shipping packaging and protective coverings shall be left in place until the equipment is prepared for installation.

B. Roof protection: All penetrations through roofs, including roof curbs, piping curbs and roof drainage system elements shall be properly protected during construction to prevent water intrusion into the building. Protective measures could include temporary covers and plugs, as well as other appropriate temporary elements.

C. Electrical enclosure protection

1. During construction, all protective covers and other devices shall be left in place that protect against inadvertent contact with live electrical circuits.

2. All warning labels related to electrical and rotating equipment hazards shall be in place prior to energizing mechanical equipment circuits.

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D. Protection of ducts and piping
   1. Maintain temporary closures on the ends of all ducts and pipes as the installation work progresses. Temporary closures include plastic sheeting, tape and appropriate caps and covers.
   2. Where debris enters piping during installation, steps shall be taken to clean the interior of the pipe prior to placing in service.
   3. Where debris enters ductwork during installation the duct interior shall be cleaned prior to placing in service.

E. Operation of HVAC systems during construction
   1. Although the operation of the permanent HVAC systems during the construction process is strongly discouraged, the Contractor shall take measures to protect the systems from contamination if they are operated.
   2. When placed in operation during the construction period, all HVAC systems shall have MERV 8 filtration in all standard filter racks throughout the systems. Where so equipped, final filter banks do not have to be in place.
   3. All return and outdoor air intake openings shall be protected with MERV 8 filter material at all points of entry into the duct system. These protections shall be maintained and remain in place until the building is prepared for final inspection.
   4. Prior to final acceptance of the building HVAC systems, the interior of all HVAC unit cabinets shall be thoroughly cleaned to “like-new” condition.

1.11 CODES AND STANDARDS

A. Mechanical installations shall conform to the current edition of the following, in addition to any previously mentioned Codes and Standards.
   1. The International Building Code.
   2. The International Mechanical Code.
   3. The International Plumbing Code.
   4. The International Fire Protection Code.
   5. The State Energy Code.
   6. NFPA Standard 70, National Electric Code.
   7. NFPA Standard 90A, Installation of Air Conditioning and Ventilation Systems.
   8. NFPA Standard 101, Code for Safety to Life for Fire in Buildings and Structures.
   9. The Guidelines for Design and Construction of Hospital and Healthcare Facilities.

1.12 INTERRUPTION OF EXISTING SERVICES

A. Exercise care so as not to cut any existing utilities or services. Where an existing utility line or service line is cut it shall be repaired to "like-new" condition. Interruption of service shall not be made without prior written permission of the Owner.

B. Plumbing, Electrical and HVAC system must remain in service during construction. Arrange with the Owner well in advance of shutdowns required for tie-ins. Shutdowns shall be made after normal occupancy hours if so directed by the Owner. No additional monies will be paid for after-hours shutdowns.

PART 2 - PRODUCTS Not required for this section.

PART 3 - EXECUTION Not required for this section.

END OF SECTION 230000

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SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract apply to this Section.

1.02 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.
   1. Piping materials and installation instructions common to most piping systems.
   2. Concrete equipment base construction requirements.
   3. Equipment nameplate data requirements.
   4. Labeling and identifying mechanical systems and equipment is specified in Division 23.
   5. Non-shrink grout for equipment installations.
   6. Field-fabricated metal and wood equipment supports.
   7. Installation requirements common to equipment specification Sections.
   8. Cutting and patching.
   9. Touchup painting and finishing.

B. Pipe and pipe fitting materials are specified in piping system Sections.

1.03 DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.04 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract.

B. Product data for following piping specialties:
   1. Mechanical sleeve seals.
   2. Identification materials and devices.
   3. Pipe freeze protection heating cables.

C. Samples of color, lettering style, and other graphic representation required for each identification material and device.

D. Shop drawings detailing fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

E. Coordination drawings for access panel and door locations.

F. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

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1.05 QUALITY ASSURANCE

A. Qualify welding processes and operators for structural steel according to AWS D1.1 "Structural Welding Code--Steel."

B. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

C. ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

D. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

E. Coordinate all electrical service requirements for mechanical equipment prior to the submittal of shop drawings. Confirm the compatibility of all power services with the equipment being furnished. Confirm compatibility of electrical lugs being provided by the equipment manufacturer with the power wiring being furnished under Division 26. Furnish written documentation that all characteristics have been coordinated with and confirmed by the electrical subcontractor.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Protect stored plastic pipes from direct sunlight. Support to prevent sagging and bending.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

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PART 2 - PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.02 JOINING MATERIALS

A. Refer to individual piping system specification Sections in Division 23 for special joining materials not listed below.

B. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch minimum thickness, except where thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.
2. ASME B16.20 for grooved, ring-joint, steel flanges.
3. AWWA C110, rubber, flat face, 1/8 inch thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.

D. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, except where other type or material is indicated.

E. Solder Filler Metal: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.

F. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvents complying with the following:

1. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D 2235.
2. Chlorinated Poly(Vinyl Chloride) (CPVC): ASTM F 493.
3. Poly(Vinyl Chloride) (PVC): ASTM D 2564.
4. PVC to ABS Transition: Made to requirements of ASTM D 3138, color other than orange.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel bolts and nuts.

2.03 PIPING SPECIALTIES

A. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
2. Insulating Material: Suitable for system fluid, pressure, and temperature.
3. Dielectric Unions: Factory-fabricated, union assembly for 250-psig minimum working pressure at a 180 deg F temperature.
4. Dielectric Flanges: Factory-fabricated, companion-flange assembly for 150- or 300-psig minimum pressure to suit system pressures.

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5. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
6. Dielectric Couplings: Galvanized-steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225 deg F temperature.
7. Dielectric Nipples: Electroplated steel nipple, having inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig working pressure at 225 deg F temperature.

B. Mechanical Sleeve Seals: Modular, watertight mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.

C. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
1. Steel Sheet-Metal: 24-gage or heavier galvanized sheet metal, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast-Iron: Cast or fabricated wall pipe equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.
   a. Penetrating Pipe Deflection: 5 percent without leakage.
   b. Housing: Ductile-iron casting having waterstop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
   c. Pipe Sleeve: AWWA C151, ductile-iron pipe.
   d. Housing-to-Sleeve Gasket: Rubber or neoprene push-on type of manufacturer's design.
5. Cast-Iron Sleeve Fittings: Commercially made sleeve having an integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.
   a. Underdeck Clamp: Clamping ring with set-screws.

2.04 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23 Sections. Where more than one type is specified for listed application, selection is Installer's option, but provide single selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped, permanently fastened to equipment.
1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
2. Location: An accessible and visible location.

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C. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.
   1. Multiple Systems: Where multiple systems of same generic name are indicated, provide identification that indicates individual system number as well as service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

2.05 GROUT
A. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B.
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory-packaged.

2.06 FIRE-STOPPING
A. Fire-Resistant Sealant: Provide UL Listed firestopping system for filling openings around penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
B. Products: Subject to compliance with requirements, provide products by one of the following:
   1. Specified Technologies, Inc.
   2. 3M Corporation
   3. Metacaulk.
   4. Hilti, Inc.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS--COMMON REQUIREMENTS
A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 23 specify piping installation requirements unique to the piping system.
B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
C. Install piping at indicated slope.
D. Install components having pressure rating equal to or greater than system operating pressure.
E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
F. Install piping free of sags and bends.
G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

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I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's printed instructions.

M. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, exterior walls and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.
    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
2. Build sleeves into new walls and slabs as work progresses.
3. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    a. Steel Pipe Sleeves: For pipes smaller than 6 inches.
    b. Steel Sheet-Metal Sleeves: For pipes 6 inches and larger that penetrate gypsum-board partitions.
    c. Cast-Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Flashing is specified in Division 7 Section "Flashing and Sheet Metal."
        1) Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.
4. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation in non-rated floors and partitions, using elastomeric joint sealants. EXCEPTION: Fire rated partition penetrations shall be sealed with U.L. Listed firestopping systems.

N. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and elastomeric sealant. Size sleeve for ½-inch annular clear space between pipe and sleeve for installation of sealant.

1. Install steel pipe for sleeves smaller than 6 inches.
2. Install sheet metal sleeve assembly for sleeves 6 inches and larger.
3. Install cast iron sleeves according to manufacturer’s preprinted instructions.

O. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with U.L. Listed firestopping sealant system.

P. Verify final equipment locations for roughing in.

Q. Refer to equipment specifications in other Sections for roughing-in requirements.

R. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.

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5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
    a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
    c. Align threads at point of assembly.
    d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
6. Welded Joints: Construct joints according to AWS D10.12 "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe" using qualified processes and welding operators according to the "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Pipe and Fitting Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following standards:
    a. Comply with ASTM F 402 for safe handling of solvent-cement and primers.
    b. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D 2235 and ASTM D 2661.
    c. Chlorinated Poly (Vinyl Chloride) (CPVC): ASTM D 2846 and ASTM F 493.
    d. Poly(Vinyl Chloride) (PVC) Pressure Application: ASTM D 2672.
    e. Poly(Vinyl Chloride) (PVC) Non-Pressure Application: ASTM D 2855.
    f. PVC to ABS (Non-Pressure) Transition: Procedure and solvent cement described in ASTM D 3138.
9. Plastic Pipe and Fitting Heat-Fusion Joints: Prepare pipe and fittings and join with heat-fusion equipment according to manufacturer's printed instructions.
    a. Plain-End Pipe and Fittings: Butt joining.
    b. Plain-End Pipe and Socket-Type Fittings: Socket joining.

S. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
1. Install unions in piping 2 inches and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch or smaller threaded pipe connection.
2. Install flanges in piping 2-1/2 inches and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
3. Install dielectric unions and flanges to connect piping materials of dissimilar metals.

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3.02 EQUIPMENT INSTALLATION--COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Design Professional.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

E. Install equipment giving right-of-way to piping systems installed at a required slope.

F. Equipment and appliances containing evaporators or cooling coils shall be installed with a means of condensate removal in compliance with IMC 307.2. A water level detection device conforming to UL 508 shall be provided for all main condensate pans and be interlocked to de-energize the unit's main fan should the drain pan water level exceed the main drain pipe connection level. Additional measures shall be taken where indicated on drawings or specifications.

3.03 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

B. Paint all exposed steel surfaces of piping and supports with one coat of primer and two coats of enamel.

3.04 CONCRETE BASES

A. Construct concrete equipment bases of dimensions indicated, but not less than 4 inches larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi, 28-day compressive strength concrete with 6 x 6 x #10 reinforcing wire mesh. Outdoor concrete bases shall extend a minimum of 4" above grade and be a minimum thickness of 6".

3.05 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code--Steel."

3.06 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.07 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair cut surfaces to match adjacent surfaces.

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3.08 GROUTING

A. Install nonmetallic non-shrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

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SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawing and general provisions of the Contract apply to this Section.

1.02 SUMMARY
A. This Section includes hangers and supports for mechanical systems piping and equipment.

1.03 DEFINITIONS
A. Terminology used in this Section is defined in MSS SP-90.

1.04 PERFORMANCE REQUIREMENTS
A. Design seismic restraint hangers and supports, for piping and equipment.
B. Design and obtain approval from authority with jurisdiction over seismic restraint hangers and supports for piping and equipment.

1.05 SUBMITTALS
A. General: Submit the following according to the Conditions of the Contract.
B. Product data for each type of hanger and support.
C. Submit pipe hanger and support schedule showing manufacturer's Figure No., size, location, and features for each required pipe hanger and support.
D. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
E. Shop drawings for each type of hanger and support, indicating dimensions, weights, required clearances, and methods of component assembly.

1.06 QUALITY ASSURANCE
A. Qualify welding processes and welding operators according to AWS D1.1 "Structural Welding Code--Steel."
1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
B. Qualify welding processes and welding operators according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
C. Listing and Labeling: Provide hangers and supports that are listed and labeled as defined in NFPA 70, Article 100.
1. UL and FM Compliance: Hangers, supports, and components include listing and labeling by UL and FM where used for fire protection piping systems.
D. Licensed Operators: Use operators that are licensed by powder-operated tool manufacturers to operate their tools and fasteners.
E. Licensed Engineer: Prepare hanger and support design drawings, and calculations for seismic restraint of piping and equipment. Include seal and signature of Registered Engineer, licensed in jurisdiction where Project is located, certifying compliance with specifications.

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PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Hangers, Supports, and Components: Factory-fabricated according to MSS SP-58.
   1. Components include galvanized coatings or alternate rust preventing shop coating.
   2. Pipe attachments include nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

B. Thermal-Hanger Shield Inserts: 100-psi average compressive strength, waterproofed calcium silicate, encased with sheet metal shield. Insert and shield cover entire circumference of pipe and are of length indicated by manufacturer for pipe size and thickness of insulation.

C. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

2.02 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36, steel plates, shapes, and bars, black and galvanized.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.

C. Washers: ASTM F 844, steel, plain, flat washers.

D. Grout: ASTM C 1107, Grade B, non-shrink, nonmetallic.
   1. Characteristics include post-hardening, volume-adjusting, dry, hydraulic-cement-type grout that is non-staining, noncorrosive, nongaseous and is recommended for both interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Water: Potable.
   4. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in the Section specifying the equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping specification Sections.

3.02 HANGER AND SUPPORT INSTALLATION

A. General: Comply with MSS SP-69 and SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible.

C. Install supports with maximum spacings complying with MSS SP-69.

D. Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

E. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Install reinforcing bars through openings at top of inserts.

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F. Install concrete inserts in new construction prior to placing concrete.

G. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches thick.

H. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches thick.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Heavy-Duty Steel Trapezes: Field-fabricate from ASTM A 36 steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

K. Support all piping direct from structure and independent of other piping.

L. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9 "Building Services Piping" is not exceeded.

O. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
3. Shields: Install MSS Type 40, protective shields on insulated piping. Shields span an arc of 180 degrees and have dimensions in inches not less than the following:

NPS (Inches)	LENGTH (Inches)	THICKNESS (Inches)
1/4 to 3-1/2	12	0.048
4	12	0.060
5 and 6	18	0.060
8 to 14	24	0.075
16 to 24	24	0.105

4. Pipes 6 Inches and Larger: Include shield inserts.
5. Insert Material: Length at least as long as the protective shield.
6. Thermal-Hanger Shields: Install with insulation of same thickness as piping.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make a smooth bearing surface.

3.04 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for pipe and equipment supports.

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B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.06 PAINTING

A. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

C. Paint all exposed steel surfaces with one coat of primer and two coats of enamel.

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SECTION 230547

SEISMIC BRACING FOR SUSPENDED UTILITIES AND FLOOR MOUNTED EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. This section covers seismic restraints for utilities and equipment including HVAC Ductwork, HVAC Piping and HVAC Equipment. Equipment seismic shall be in accordance with IBC 2006 and calculations for anchorage shall be provided per the code.

1.02 SEISMIC BRACING

A. Seismic bracing shall comply with the following standards.
   1. Seismic design criteria as indicated on the Structural Drawings.
   2. 2006 International Building Code Chapter 16 Earthquake Loads.
   3. ASCE 7-10
   4. 2012 International Building Code Chapter 17 Structural Tests and Special Inspections.

1.03 SUBMITTALS

A. Submittals to include appropriate details and reflect actual jobsite conditions. Submittal to be wet stamped by a registered structural engineer specialized in the design of seismic restraints and licensed in the state where the project is located.

B. Jobsite conditions not covered by the manufacturer's design manual shall be engineered on an individual basis and all calculations and details shall be wet stamped by a registered structural engineer specialized in the design of seismic restraints and licensed in the state where the project is located.

C. Submit seismic bracing layouts for all suspended utilities on shop drawings wet stamped by a registered Structural Engineer specialized in the design of seismic restraints and licensed in the state where the project is located. The basis for the layouts shall be the utility contractors shop drawings, and the addition of the bracing locations shall be the responsibility of this section.

D. Layout drawings to include:
   1. All vertical support and seismic bracing locations.
   2. All vertical support and seismic bracing connections to the structure (Anchorage Manufacturer, Quantity and Size for each location.)
   3. Vertical Support and brace arm reactions at all connection points to the structure (for the Structural Engineer of Record use in checking suitability of the building structure.
   4. Type and size of brace member.
   5. Reference installation detail #'s for vertical support and seismic bracing.
   6. Maximum Transverse Lateral and Longitudinal brace spacing for each utility.
   7. Seismic accelerations each utility has been designed to resist.
   8. Suspended utility max weight per lineal foot (lbs/1f) or max pipe/conduit size at all seismic locations.
   9. Minimum all threaded rod size at all seismic locations.

1.04 SPECIFICATION QUALITY ASSURANCE

A. Where the Component Importance Factor (Ip) is greater than 1.0 for any mechanical, electrical, component or system, that system is considered to be a "Designated Seismic System" per Chapter 17 of the 2012 IBC. Each Contractor responsible for the construction of a Designated Seismic System shall submit a written "statement of responsibility", per the 2012 IBC, to the building official and owner prior to the commencement of work on the system or component.

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B. Upon completion of construction a Quality Assurance Representative of the seismic force resisting system manufacturer / designer shall review the installation of the seismic-force-resisting system and provide documentation indicating conformance to shop drawing seismic restraint layout and with the manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   1. ISAT (International Seismic Application Technology)
   2. Unistrut
   3. Gripple
   4. Tolco
   5. Loos

B. Material Requirements:
   1. All manufacturer specific components that are part of the seismic-resistance system must be strength tested by third party vendors with test reports available upon request.
   2. All anchors utilized as part of the component anchorage and /or seismic anchorage must comply with ASCE 7-10. Specifically all anchors must be tested for seismic applications in conformance with ACI 355.2.

2.02 SPECIFICATION DEVIATIONS

A. Any contractor or manufacturer wishing to deviate for the project code requirements must submit in writing the following:
   1. Deviation requested
   2. Reason for the deviation to include code or local jurisdiction allowances
   3. Cost impact for deviation

B. A manufacturer's letter of exception will not be considered acceptable justification for deviations. Deviations citing differences between SMACNA and IBC/ASCE exclusions as reasoning for deviation will not be considered.

2.03 PROJECT SPECIFIC CHARACTERISTICS

A. Building Seismic Design Category: As indicated on the structural and architectural drawings.

B. Building Occupancy Category: As indicated on the structural and architectural drawings.

C. All non-structural mechanical components on this project have an importance factor of 1.0 or (1.5) (per mechanical engineer)

PART 3 – EXECUTION

3.01 INSTALLATION OF SEISMIC BRACING

A. Installation of seismic bracing systems shall be in accordance with manufacturer's instructions and requirements as well as the governing codes cited above.

END OF SECITON 230547

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SECTION 230593

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
   1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
   2. Adjusting total HVAC systems to provide indicated quantities.
   3. Measuring electrical performance of HVAC equipment.
   4. Setting quantitative performance of HVAC equipment.
   5. Verifying that automatic control devices are functioning properly.
   6. Measuring sound and vibration.
   7. Reporting results of the activities and procedures specified in this Section.

B. Related Sections include the following:
   1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
   2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.03 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

G. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

H. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

I. Test: A procedure to determine quantitative performance of a system or equipment.

J. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

K. AABC: Associated Air Balance Council.

L. AMCA: Air Movement and Control Association.

M. NEBB: National Environmental Balancing Bureau.

N. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

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1.04 SUBMITTALS

A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.

B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.

C. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.

D. Certified Testing, Adjusting, and Balancing Reports: Submit 3 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

E. Sample Report Forms: Submit 3 sets of sample testing, adjusting, and balancing report forms.

F. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.05 QUALITY ASSURANCE

A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.

B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Design Professional's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:
    a. Submittal distribution requirements.
    b. Contract Documents examination report.
    c. Testing, adjusting, and balancing plan.
    d. Work schedule and Project site access requirements.
    e. Coordination and cooperation of trades and subcontractors.
    f. Coordination of documentation and communication flow.

C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.

D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

E. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards or in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

F. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

G. Test and balance process is not deemed as accepted until a complete report is received free of deficiencies and discrepancies and approved in writing by the Engineer.

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1.06 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Material Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.07 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.08 WARRANTY

A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Furnish one of the following:

1. National Project Performance Guarantee: Provide a guarantee on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents.
2. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents.
3. The certified Agent has tested and balanced systems according to the Contract Documents.
4. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
2. Verify that balancing devices are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine project record documents.

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D. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

F. Examine system and equipment test reports.

G. Examine HVAC system and equipment installations to verify that indicated balancing devices, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

H. Review manufacturer's certification for each piece of HVAC equipment to be tested. Test and balance shall not be performed until certification letters have been obtained.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine equipment for installation and for properly operating safety interlocks and controls.

L. Examine automatic temperature system components to verify the following:
   1. Dampers, valves, and other controlled devices operate by the intended controller.
   2. Dampers and valves are in the position indicated by the controller.
   3. Thermostats and sensors are located to avoid adverse effects of sunlight, drafts, and cold walls.
   4. Sensors are located to sense only the intended conditions.
   5. Sequence of operation for control modes is according to the Contract Documents.
   6. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
   7. Interlocked systems are operating.
   8. Changeover from heating to cooling mode occurs according to design values.

M. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.02 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:
   1. Permanent electrical power wiring is complete.
   2. Automatic temperature-control systems are operational.
   3. Equipment and duct access doors are securely closed.
   4. Balance, smoke, and fire dampers are open.
   5. Isolating and balancing valves are open and control valves are operational.

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6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so design conditions for system operations can be met.

3.03 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or AABC National Standards and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.04 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity (if necessary).

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

3.05 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume exhaust-air systems.

B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:
   a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
2. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.

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3. Adjust fan speed higher or lower than design with the approval of the Design Professional. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

3.06 BI-POLAR IONIZATION UNITS

A. Confirm operation of bi-polar ionization units, where installed, using an ion counter meter. Report any non-conforming units.

3.07 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating if high-efficiency motor.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.08 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.09 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Verify free travel and proper operation of control devices such as damper and valve operators.

F. Verify sequence of operation of control devices.

G. Confirm interaction of electrically operated switch transducers.

H. Confirm interaction of interlock and lockout systems.

I. Record voltages of power supply and controller output. Determine if the system operates on a grounded or non-grounded power supply.

J. Note operation of electric actuators using spring return for proper fail-safe operations.

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3.10 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:
   1. Exhaust Fans: Plus 5 to plus 10 percent.

3.11 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
   1. Include a list of the instruments used for procedures, along with proof of calibration.
   2. Include letters from HVAC equipment manufacturers certifying that each piece of equipment has been installed and commissioned in accordance with manufacturer’s recommendations.

C. Final Report Contents: In addition to the certified field report data, include the following:
   1. Fan curves.
   2. Manufacturers' test data.
   3. Field test reports prepared by system and equipment installers.
   4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

3.13 ADDITIONAL TESTS

A. Seasonal Periods: Perform testing, adjusting, and balancing procedures during near-peak summer (above 85ºF) and during near-peak winter conditions (below 40ºF.) Retainage may be held until each season has been tested. Refer to contract documents.

END OF SECTION 230593

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SECTION 230700

HVAC INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of Contract apply to this Section.

1.02 SUMMARY
- A. This Section includes pipe, duct, and equipment insulation.

1.03 DEFINITIONS
- A. Hot Surfaces: Normal operating temperatures of 100 deg F or higher.
- B. Dual-Temperature Surfaces: Normal operating temperatures that vary from hot to cold.
- C. Cold Surfaces: Normal operating temperatures less than 75 deg F.
- D. Thermal resistivity is designated by an r-value that represents the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivity (r-value) is expressed by the temperature difference in degrees Fahrenheit between the two exposed faces required to cause 1 BTU per hour to flow through 1 square foot at mean temperatures indicated.
- E. Thermal Conductivity (k-value): Measure of heat flow through a material at a given temperature difference; conductivity is expressed in units of Btu x inch/h x sq. ft. x deg F.
- F. Density: Is expressed in lb./cu.ft.

1.04 SUBMITTALS
- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data for each type of mechanical insulation identifying k-value, thickness, and accessories.

1.05 QUALITY ASSURANCE
- A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.
  1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.
  2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

1.06 SEQUENCING AND SCHEDULING
- A. Schedule insulation application after testing of piping and duct systems.
- B. Schedule insulation application after installation and testing of heat trace tape.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. Glass Fiber:
   a. CertainTeed Corporation.
   b. Knauf Fiberglass GmbH.
   c. Manville.
   d. Owens-Corning Fiberglas Corporation.
   e. USG Interiors, Inc. - Thermafiber Division.
2. Flexible Elastomeric Cellular:
   a. Armaflex; Armacell LLC
   b. K-Flex; Nomaco K-Flex Corporation.
   c. Aerocel; Aeroflex USA, inc.

2.02 GLASS FIBER

A. Material: Inorganic glass fibers, bonded with a thermosetting resin.

B. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.

C. Board: ASTM C 612, Class 2, semi-rigid jacketed board.
   1. Thermal Conductivity: 0.26 Btu x inch/h x sq. ft. x deg F average maximum, at 75 deg F mean temperature.
   2. Density: 3 pcf minimum.

D. Blanket: ASTM C 553, Type II, Class F-1, jacketed flexible blankets.
   1. Thermal Conductivity: 0.32 Btu x inch/h x sq. ft. x deg F average maximum, at 75 deg F mean temperature.
   2. Density: 3/4 pcf minimum within building envelope.
   3. Density: 1 pcf minimum exterior to building envelope.

E. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, jacketed.
   1. Thermal Conductivity: 0.26 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F mean temperature.
   2. Density: 3 pcf minimum.

F. Adhesive: Produced under the UL Classification and Follow-up service.
   1. Type: Non-flammable, solvent-based.
   2. Service Temperature Range: Minus 20 to 180 deg F.

G. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

2.03 FLEXIBLE ELASTOMERIC CELLULAR

A. Material: Flexible expanded closed-cell structure with smooth skin on both sides.
   1. Tubular Materials: ASTM C 534, Type I.
   2. Sheet Materials: ASTM C 534, Type II.

B. Thermal Conductivity: 0.25 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F.

C. Coating: Water based latex enamel coating recommended by insulation manufacturer.

D. Fire Performance Characteristics: Provide material having the following fire performance characteristics as determined by UL in accordance with ASTM Standard E84:
   Flame Spread = 25
   Smoke Developed = 50

2.04 INSULATING CEMENTS

A. Mineral Fiber, Hydraulic-Setting Insulating and Finishing Cement: ASTM C 449.
   1. Thermal Conductivity: 1.2 Btu x inch/h x sq. ft. x deg F average maximum at 400 deg F mean temperature.
   2. Compressive Strength: 100 psi at 5 percent deformation.

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2.05 ADHESIVES

A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive recommended by insulation manufacturer.

B. Lagging Adhesive: MIL-A-3316C, non-flammable adhesive in the following Classes and Grades:

1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to unfaced glass fiber insulation.
2. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

2.06 JACKETS

A. General: ASTM C 921, Type 1, except as otherwise indicated.

B. Foil and Paper Jacket: Laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

1. Water Vapor Permeance: 0.02 perm maximum, when tested according to ASTM E 96.
2. Puncture Resistance: 50 beach units minimum, when tested according to ASTM D 781.

C. PVC Jacketing: High-impact, ultra-violet-resistant PVC, 20 mils thick, roll stock ready for shop or field cutting and forming to indicated sizes.

1. Adhesive: As recommended by insulation manufacturer.

D. PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20 mil thick, high-impact, ultra-violet-resistant PVC.

1. Adhesive: As recommended by insulation manufacturer.

E. Aluminum Jacket: ASTM B 209, 3003 Alloy, H-14 temper, factory cut and rolled to indicated sizes.

F. Aluminum Jacket: ASTM B 209, 3003 Alloy, H-14 temper, roll stock ready for shop or field cutting and forming to indicated sizes.

1. Finish and Thickness: Smooth finish, 0.010 inch thick.
2. Moisture Barrier: 1 mil, heat-bonded polyethylene and kraft paper.
3. Elbows: Preformed 45-degree and 90-degree, short- and long-radius elbows, same material, finish, and thickness as jacket.

2.07 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, presized a minimum of 8 ounces per sq. yd.

1. Tape Width: 3 inches.
2. Cloth Standard: MIL-C-20079H, Type I.
3. Tape Standard: MIL-C-20079H, Type II.

B. Bands: ¾-inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: Type 304, 0.020 inch thick.
2. Galvanized Steel: 0.005 inch thick.
3. Aluminum: 0.007 inch thick.
4. Brass: 0.01 inch thick.
5. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 14 gage nickel copper alloy, 16 gage, soft-annealed stainless steel, or 16 gage, soft-annealed galvanized steel.

D. Corner Angles: 28 gage, 1 inch by 1-inch aluminum, adhered to 2 inches by 2 inches kraft paper.

E. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

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2.08 SEALING COMPOUNDS

A. Vapor Barrier Compound: Water-based, fire-resistive composition.
   1. Water Vapor Permeance: 0.08 perm maximum.
   2. Temperature Range: Minus 20 to 180 deg F.

B. Weatherproof Sealant: Flexible-elastomer-based, vapor-barrier sealant designed to seal metal joints.
   1. Water Vapor Permeance: 0.02 perm maximum.
   2. Temperature Range: Minus 50 to 250 deg F.
   3. Color: Aluminum.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.

B. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless-steel surfaces with demineralized water.
   1. Follow cement manufacturer's printed instructions for mixing and portions.

3.02 INSTALLATION, GENERAL

A. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical system.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

C. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 60 deg F.

D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight, and even surfaces.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

I. Apply adhesives and coatings at manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

K. Items Not Insulated: Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment:
   1. Fibrous glass ducts.
   2. Factory-insulated flexible ducts.
   3. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
   4. Flexible connectors for ducts and pipes.
   5. Vibration control devices.
   6. Testing laboratory labels and stamps.
   7. Nameplates and data plates.
   8. Pre-insulated access panels and doors in air distribution systems.

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3.03 PIPE INSULATION INSTALLATION, GENERAL

A. Tightly butt longitudinal seams and end joints. Bond with adhesive.

B. Stagger joints on double layers of insulation.

C. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.

D. Apply insulation with a minimum number of joints.

E. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Cover circumferential joints with butt strips, at least 3 inches wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches on center.
3. Longitudinal Seams: Overlap seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center.
   a. Exception: Do not staple longitudinal laps on insulation applied to piping systems with surface temperatures at or below 35 deg F.
4. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.
6. Repair damaged insulation jackets, except metal jackets, by applying jacket material around damaged jacket. Adhere, staple, and seal. Extend patch at least 2 inches in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.

F. Wall and Partition Penetration: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

G. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with a U.L. Listed firestopping or fire-resistant joint sealer.

H. Flanges, Fittings, and Valves - Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply pre-molded, precut, or field-fabricated segments of insulation around flanges, unions, valves, and fittings. Make joints tight. Bond with adhesive.

1. Use same material and thickness as adjacent pipe insulation.
2. Overlap nesting insulation by 2 inches or 1-pipe diameter, which ever is greater.
3. Apply materials with adhesive, fill voids with mineral fiber insulating cement. Secure with wire or tape.
4. Insulate elbows and tees smaller than 3 inches pipe size with pre-molded insulation.
5. Insulate elbows and tees 3 inches and larger with pre-molded insulation or insulation material segments. Use at least 3 segments for each elbow.
6. Cover insulation, except for metal jacketed insulation, with PVC fitting covers and seal circumferential joints with butt strips.

I. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields, and inserts as specified in Division 23 Section "Hangers and Supports."

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3.04 GLASS FIBER PIPE INSULATION INSTALLATION

A. Bond insulation to pipe with lagging adhesive.
B. Seal exposed ends with lagging adhesive.
C. Seal seams and joints with vapor barrier compound.

3.05 FLEXIBLE ELASTOMERIC CELLULAR PIPE INSULATION INSTALLATION

A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.
B. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.
    1. Miter cut materials to cover soldered elbows and tees.
    2. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

3.10 EQUIPMENT INSULATION INSTALLATION, GENERAL

A. Install board and block materials with a minimum dimension of 12 inches and a maximum dimension of 48 inches.
B. Groove and score insulation materials as required to fit as closely as possible to the equipment and to fit contours of equipment. Stagger end joints.
C. Insulation Thicknesses Greater than 2 Inches: Install insulation in multiple layers with staggered joints.
D. Bevel insulation edges for cylindrical surfaces for tight joint.
E. Secure sections of insulation in place with wire or bands spaced at 9 inches centers, except for flexible elastomeric cellular insulation.
F. Protect exposed corners with corner angles under wires and bands.
G. Manholes, Handholes, and Information Plates: Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
H. Removable Insulation: Install insulation on components that require periodic inspecting, cleaning, and repairing for easy removal and replacement without damage to adjacent insulation.
I. Finishing: Except for flexible elastomeric cellular insulation, apply 2 coats of vapor barrier compound to a minimum thickness of 1/16 inch. Install a layer of glass cloth embedded between layers.

3.11 GLASS FIBER EQUIPMENT INSULATION INSTALLATION

A. Secure insulation with anchor pins and speed washers.
B. Space anchors at maximum intervals of 18 inches in both directions and not more than 3 inches from edges and joints.
C. Apply a smoothing coat of insulating and finishing cement to finished insulation.

3.12 FLEXIBLE ELASTOMERIC CELLULAR EQUIPMENT INSULATION INSTALLATION

A. Install sheets of the largest manageable size.
B. Apply full coverage of adhesive to the surfaces of the equipment and to the insulation.
C. Butt insulation joints firmly together and apply adhesive to insulation edges at joints.

3.13 DUCT INSULATION

A. Install block and board insulation as follows:
    1. Adhesive and Band Attachment: Secure block and board insulation tight and smooth with at least 50 percent coverage of adhesive. Install bands spaced 12 inches apart. Protect insulation under bands and at exterior corners with metal corner angles. Fill joints, seams, and chipped edges with vapor barrier compound.

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2. Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches apart each way and 3 inches from insulation joints. Apply vapor barrier coating compound to insulation in contact, open joints, breaks, punctures, and voids in insulation.

B. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:
   1. Smaller Than 24 Inches: Bonding adhesive applied in 6 inches wide transverse strips on 12 inches centers.
   2. 24 Inches and Larger: Anchor pins spaced 12 inches apart each way. Apply bonding adhesive to prevent sagging of the insulation.
   3. Overlap joints 3 inches.
   4. Seal joints, breaks, and punctures with vapor barrier compound and glass tape (glasfab and mastic).

3.14 FINISHES

A. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed exterior insulation.

3.15 APPLICATIONS

A. General: Materials and thicknesses are specified in schedules at the end of this Section.

B. Piping Systems: Unless otherwise indicated, insulate the following piping systems:
   1. Condenser water piping outdoors, aboveground.
   2. Air conditioning condensate drains and sanitary P-traps receiving air conditioning condensate.
   3. All refrigerant piping used for split systems with inverter-outdoor units (i.e. mini-splits, ductless split systems.)

C. Duct Systems: Unless otherwise indicated, insulate the following duct systems:
   1. Supply, return and outside air ductwork. (Except double-wall spiral duct exposed in occupied building spaces.)
   2. Above-ceiling surfaces of all air devices except where pre-insulated.

3.16 PIPE INSULATION SCHEDULES

A. General: Furnish insulation vapor barrier on all piping carrying fluids below 60ºF.

B. Schedules:
   1. All refrigerant piping used for split systems with inverter driven outdoor units (i.e. mini-splits, ductless split systems): 3/4” flexible elastomeric insulation. Paint exterior insulation with two coats of manufacturer’s recommended coating
   2. Air Conditioning Condensate Drain Piping: 3/8" flexible elastomeric insulation (interior applications only).

3.17 DUCTWORK AND PLENUM INSULATION SCHEDULES

A. General: Furnish vapor barrier on all ductwork insulation.

B. Schedules:
   1. Interior Supply, return, and relief ductwork and outdoor air ductwork
      a. Lined and unlined within building envelope: 2" glass fiber blanket. Seal all joints and penetrations in jacket with glasfab and mastic.
      b. Outside Building Envelope: 3” glass fiber blanket or board.
   2. Supply, Return, and Outdoor Air Ductwork (lined and unlined) Exposed in Mechanical Rooms: 2" glass fiber board.

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3.18 INSULATION EXPOSED IN MECHANICAL ROOMS:

A. Finish all piping, equipment and ductwork insulation exposed in each mechanical room with a field applied 8 ounce per square yard canvas jacket cemented in place with white lagging adhesive.

B. Apply PVC pipe fitting covers over canvas.

C. Paint canvas with two coats of enamel paint. Colors shall be approved by the Design Professional. Piping insulation shall be painted in accordance with the Owner's color scheme.

3.19 RANGEHOOD EXHAUST INSULATION SCHEDULE

A. Rangehood Grease Exhaust Duct: Grease duct insulation blanket installed in a manner which will achieve a 2-hour rating.

END OF SECTION 230700

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SECTION 230900

CONTROL SYSTEMS EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

A. This Section includes control equipment for HVAC systems and components.

B. Related Section: Division 23 Section "Sequence of Operation" contains requirements that relate to this Section.

1.03 SYSTEM DESCRIPTION

A. Control system consists of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories connected to controllers to operate mechanical systems according to sequences of operation indicated or specified.

1.04 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.

B. Product Data for each type of product specified. Include manufacturer's technical Product Data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, installation instructions, and startup instructions.

C. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Submit damper leakage and flow characteristics, plus size schedule for controlled dampers.

D. Shop Drawings containing the following information for each control system:

1. Each control device labeled with setting or adjustable range of control.
2. Diagrams for all required electrical wiring. Clearly differentiate between factory-installed and field-installed wiring.
3. Details of control panel faces, including controls, instruments, and labeling.
4. Written description of sequence of operation.

E. Wiring diagrams detailing wiring for power, signal, and control systems and differentiating clearly between manufacturer-installed and field-installed wiring. Furnish wiring diagrams and coordination documentation for all controlled equipment furnished by other suppliers under Division 23.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer specializing in control system installations.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing control systems similar to those indicated for this Project and that have a record of successful in-service performance.

C. Startup Personnel Qualifications: Engage specially trained personnel in direct employ of manufacturer of primary temperature control system.

D. Comply with NFPA 90A.

E. Comply with NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store equipment and materials inside and protected from weather.

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B. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping control devices to unit manufacturer.

PART 2 - PRODUCTS

2.01 THERMOSTATS

A. Wall Mount Thermostats, General: Mount 4'-6" A.F., unless indicated otherwise. Coordinate mounting height with architect.

B. Thermostats:

1. HVAC unit thermostats shall be manufacturer's standard electronic 7-day programmable model having a Off-Em-Ht.-Heat-Auto-Cool System switch and an Auto-On Fan switch. Provide multi-stage heating and cooling thermostat where controlled unit has multi-stage capability. Outdoor thermostat shall prevent strip heat from being energized above 45 degrees F. (Emergency heat position not required for non-heat pump unit.)

a. System switching positions shall control thermostat operation as follows:

1) OFF - heating and cooling systems are off. If the fan switch is at the AUTO position, the cooling fan is also off.

2) HEAT - heating system is controlled by the thermostat. Cooling system is off.

3) AUTO - thermostat automatically switches between heat and cool modes, depending upon the indoor temperature.

4) COOL - thermostat controls the cooling system. Heating system if off.

5) EM.HT (Heat Pump Units Only) - emergency heat relay is energized on call for heat. Cooling system is off. Compressor is de-energized.

b. Fan switching positions shall control fan operation as follows:

1) ON - fan operates continuously.

2) AUTO - fan operates as controlled by the thermostat in heat pump systems for conventional cooling mode; fan shall operate as controlled by plenum switch in conventional heating mode.

c. Furnish unit with the following features:

1) Override function.

2) Proportional plus integral control.

3) Automatic changeover.

4) Keypad lockout.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field end devices and wiring are installed before proceeding with installation.

3.02 INSTALLATION

A. Install equipment as indicated to comply with manufacturer's written instructions.

B. Connect and configure equipment and software to achieve the sequence of operation specified.

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C. Provide guards on thermostats in the following locations:
   1. Entrances.
   2. Public areas.
   3. Where indicated.
D. Install damper motors on outside of duct in warm areas, not where exposed to outdoor temperatures.
E. Install labels and nameplates to identify control components according to Division 23 Sections specifying mechanical identification.
F. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."
G. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

3.03 ELECTRICAL WIRING AND CONNECTIONS

A. Install raceways, boxes, and cabinets according to Division 26.
B. Install building wire and cable according to Division 26.
C. Connect electrical components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.
D. Make electrical connections to power supply and electrically operated meters and devices.

3.04 COMMISSIONING

A. Manufacturer's Field Services: Provide the services of a factory-authorized service representative to start control systems.
B. Test and adjust controls and safeties.
C. Replace damaged or malfunctioning controls and equipment.
D. Demonstrate compliance with requirements.
E. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.05 DEMONSTRATION

A. Manufacturer's Field Services: Provide the services of a factory-authorized service representative to demonstrate and train Owner's maintenance personnel as specified below.
   1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
   2. Schedule training with Owner with at least 7 days' notice.

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SECTION 230993

SEQUENCE OF OPERATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY
A. This Section includes control sequences for HVAC systems and terminal units.
B. Related Section: Division 23 Section "Control Systems Equipment" contains requirements that relate to this Section.

1.03 UNITARY SYSTEMS
A. Split Systems (ductless):
1. Split systems shall be controlled by individual thermostats furnished by the manufacturer. Heating or cooling shall be energized as required to maintain space temperature.

1.04 HEATING, VENTILATION AND HUMIDIFICATION SYSTEMS
A. Electric Unit Heaters: When space temperature falls below thermostat setpoint, the unit fan and heating coils shall energize.
B. Heat Trace: The heat trace (piping) shall be self-regulating. An outdoor thermostat shall lock the heat trace out when the temperature exceeds 45ºF.
C. Fans: See fan schedule.
1. Where fans are indicated to be interlocked with room lighting, furnish starters/contactors as required for control operation.

1.05 SUBMITTALS
A. General: Submit the following according to the Conditions of the Contract.
B. Shop Drawings showing operating sequences of various equipment, devices, components, and materials included in the Text and defining the components' contribution to the system.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

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SECTION 232300

REFRIGERANT PIPING AND CONDENSATE DRAINS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications, including pipes, tubing, fittings, and specialties; special-duty valves; and refrigerants. It also includes piping used for air conditioning condensate drainage.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.

B. Product Data for each valve type and refrigerant piping specialty specified.

C. Shop Drawings showing layout of refrigerant piping, specialties, and fittings, including pipe and tube sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.

1. Refrigerant piping indicated is schematic only. Size and design the layout and installation of the piping, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and conformance with warranties of connected equipment.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

E. Maintenance data for refrigerant valves and piping specialties to include in the operation and maintenance manual.

1.04 QUALITY ASSURANCE

A. ASME Compliance: Qualify brazing and welding processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications."

B. Regulatory Requirements: Comply with provisions of the following codes:

1. ASME B31.5, "Refrigeration Piping."
2. ASHRAE 15, "Safety Code for Mechanical Refrigeration."

C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

D. Listing and Labeling: Provide products specified in this Section that are UL listed and labeled.

1.05 SEQUENCING AND SCHEDULING

A. Coordinate the installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. Refrigerants:
   a. Allied Signal Inc.; Genetron Refrigerants.
   b. DuPont Company; Fluorochemicals Div.
   c. Elf Atochem North America, Inc.
   d. ICI Americas Inc.; Fluorochemicals Bus.
2. Refrigerant Valves and Specialties:
   a. Danfoss Electronics, Inc.
   b. Eaton Corporation; Industrial Control Div.
   c. Emerson Electric Company; Alco Controls Div.
   d. Henry Valve Company.
   e. Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.
   f. Sporlan Valve Company.

2.02 PIPES AND TUBES

A. Copper Tube: ASTM B 280, Type ACR.
B. Copper Tube: ASTM B 88, Type L.

2.03 PIPE AND TUBE FITTINGS

A. Copper Fittings: ASME B16.22, wrought-copper streamlined pattern.

2.04 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).

2.05 VALVES

A. Solenoid Valves: Conform to ARI 760; 250 deg F temperature rating, 400-psig working pressure; forged brass, with PTFE valve seat, 2-way straight-through pattern, and solder-end connections; manual operator; with NEMA 250, Type 1 solenoid enclosure with 1/2-inch conduit adapter, and 24-V normally closed holding coil.
B. Pressure-Regulating Valves: Conform to ARI 770; pilot operated, forged brass or cast bronze with pilot operator, stainless-steel bottom spring, pressure-gage tappings, 24-V dc standard coil, and wrought-copper fittings for solder-end connections.
C. Pressure-Regulating Valves: Conform to ARI 770; direct acting, brass with pilot operator, stainless-steel diaphragm, standard coil, and solder-end connections.
D. Pressure Relief Valves: Straight or angle brass body and disc, neoprene seat, factory sealed and ASME labeled, for standard pressure setting.
E. Thermal Expansion Valves: Conform to ARI 750; thermostatic-adjustable, modulating type; size as required and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.
F. Hot-Gas Bypass Valve: Adjustable, sized for capacity equal to last step of compressor unloading; solder-end connections.

2.06 REFRIGERANT PIPING SPECIALTIES

A. Moisture/Liquid Indicators: 500-psig operating pressure, 200 deg F operating temperature; forged-brass body, with replaceable, polished, optical viewing window with color-coded moisture indicator, and solder-end connections.
B. Permanent Filter-Dryer: 500-psig maximum operating pressure, 225 deg F maximum operating temperature; steel shell, and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.

2.07 RECEIVERS

A. 6-Inch Diameter and Smaller: ARI 495, UL listed, steel, brazed; 400-psig pressure rating, with tappings for inlet, outlet, and pressure relief valve.

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B. More than 6-Inch Diameter: ARI 495, welded steel, tested and stamped according to ASME Boiler and Pressure Vessel Code, Section 8D; 400 psig with tappings for liquid inlet and outlet valves, pressure relief valve, and liquid-level indicator.

2.08 REFRIGERANT

A. ASHRAE 34, R-410-A: Pentofluoroethane Difluouromethane.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for compliance with requirements for installation tolerances and other conditions affecting performance of refrigerant piping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Aboveground refrigerant piping: Type ACR copper tubing.

B. Aboveground condensate drain piping: Type L copper tubing.

3.03 INSTALLATION

A. Install refrigerant piping according to ASHRAE 15.

B. Basic piping installation requirements are specified in Division 23.

C. Install piping in short and direct arrangement, with minimum number of joints, elbows, and fittings.

D. Arrange piping to allow normal inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.

E. Install piping with adequate clearance between pipe and adjacent walls and hangers, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

F. Insulate refrigerant suction lines and hot gas lines. Insulate all refrigerant lines on inverter-driven split systems and variable refrigerant flow system.

1. Do not install insulation until system testing has been completed and all leaks have been eliminated.

G. Install branch lines to parallel compressors of equal length, and pipe identically and symmetrically.

H. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

I. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope of 0.4 percent downward away from compressor.
2. Install horizontal suction lines with a uniform slope of 0.4 percent downward to compressor.
3. Install traps and double risers where indicated or where required to entrain oil in vertical runs.
4. Liquid lines may be installed level.

J. Use fittings for changes in direction and branch connections.

K. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

L. Reduce pipe sizes using eccentric reducer fittings installed with level side down.

M. Install refrigerant valves according to manufacturer's written instructions.

N. When brazing, remove solenoid-valve coils; remove sight glasses; and remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties. Do not apply heat near bulb of expansion valve.

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O. Electrical wiring for solenoid valves is provided under Division 23 and specified in Division 26 Sections. Coordinate electrical requirements and connections.

P. Mount thermostatic expansion valves in any position, close to evaporator.
   1. Where refrigerant distributors are used, mount directly on expansion-valve outlet.
   2. Install valve so diaphragm case is warmer than bulb.
   3. Secure bulb to clean, straight, horizontal section of suction line using 2 bulb straps. Do not mount bulb in a trap or at the bottom of the line.
   4. Where external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

Q. Install pressure relief valves as required by ASHRAE 15. Pipe pressure relief valves on receivers to outdoors.

R. Charge and purge systems, after testing, and dispose of refrigerant following ASHRAE 15 procedures.

S. Charge system per industry accepted standards for systems utilizing R-410A, or manufacturer's recommended procedures if more stringent than industry standards. The following is an outline of the triple evacuation method.
   1. Pull initial vacuum on the line set testing for a leak. If it holds then pressure test with Nitrogen at 300 psi minimum.
   2. Pump system down, recharge with Nitrogen to 2 psi. Perform this step two times.
   3. Pump system down, re-pressurize with Nitrogen and then evacuate system to 500 microns. Hold for 30 minutes.
   4. Break vacuum with refrigerant and charge per manufacturer's directions.

3.04 HANGERS AND SUPPORTS

A. General: Hangers, supports, and anchors are specified in Division 23 Sections. Provide according to ASME B31.5 and MSS SP-69.

B. Adjustable steel clevis hangers or swivel loop hangers for individual horizontal runs less than 20 feet in length.

C. Roller hangers and spring hangers for individual horizontal runs 100 feet or longer.

D. Pipe rollers for multiple horizontal runs, 100 feet or longer supported by a trapeze.

E. Spring hangers to support vertical runs.

F. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes. Tube sizes are nominal or standard tube sizes as expressed in ASTM B 88.
   1. 1/2 Inch: Maximum span, 60 inches; minimum rod size, 1/4 inch.
   2. 5/8 Inch: Maximum span, 60 inches; minimum rod size, 1/4 inch.
   3. 1 Inch: Maximum span, 60 inches; minimum rod size, 1/4 inch.
   4. 1-1/4 Inches: Maximum span, 72 inches; minimum rod size, 1/4 inch.
   5. 1-1/2 Inches: Maximum span, 96 inches; minimum rod size, 3/8 inch.
   6. 2 Inches: Maximum span, 96 inches; minimum rod size, 3/8 inch.
   7. 2-1/2 Inches: Maximum span, 108 inches; minimum rod size, 3/8 inch.
   8. 3 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   9. 4 Inches: Maximum span, 12 feet; minimum rod size, 1/2 inch.

G. Support vertical runs at each floor.

3.05 PIPE JOINT CONSTRUCTION

A. Basic pipe and tube joint construction is specified in Division 23 Sections.

B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent formation of scale.

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3.06 VALVE INSTALLATIONS

A. Install refrigerant valves according to manufacturer's written instructions. Provide liquid line solenoid valves for 7½-ton systems and larger, and where recommended by the HVAC equipment manufacturer.
   1. Install solenoid valves in horizontal lines with coil at top.
   2. Electrical wiring for solenoid valves is provided under Division 23 and specified in Division 26 Sections. Coordinate electrical requirements and connections.

B. Provide thermal expansion valve (TXV) or electronic expansion valve (EEV) on all systems:
   1. For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
   2. Size valves to provide full rated capacity of cooling coil serviced. Coordinate selection with evaporator coil and condensing unit.
   3. Install valves in accordance with equipment and valve manufacturer's instructions.

C. Install pressure-regulating and relief valves as required by ASHRAE 15.

3.07 SPECIALTIES APPLICATION AND INSTALLATION

A. Install liquid indicators in liquid line leaving condenser, in liquid line leaving receiver, and on leaving side of liquid solenoid valves.

B. Install pressure relief valves on ASME receivers, and pipe to outdoors.

C. Install filter-dryers in liquid line adjacent to receivers, coils and before each solenoid valve.

D. Install receivers on systems 5 tons and larger, and on systems with long piping runs, sized to accommodate pump-down charge.

3.08 CONNECTIONS

A. Electrical: Conform to applicable requirements of Division 26 Sections for electrical connections.

3.09 FIELD QUALITY CONTROL

A. Inspect and test refrigerant piping according to ASME B31.5, Chapter VI.
   1. Pressure test with nitrogen per accepted industry practices using soap bubbles or electronic leak detector. Test to no leakage.

B. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

C. Repair leaks using new materials; retest.

3.10 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements. Adjust hot gas bypass valve for proper unloading.

3.11 CLEANING

A. Before installation of copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.

3.12 COMMISSIONING

A. Charge system per industry accepted standards for systems utilizing R-410A, or manufacturer's recommended procedures if more stringent than industry standards. The following is an outline of the triple evacuation method.
   1. Pull initial vacuum on the line set testing for a leak. If it holds then pressure test with Nitrogen at 300 psi minimum.
   2. Pump system down, recharge with Nitrogen to 2 psi. Perform this step two times.

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3. Pump system down, re-pressurize with Nitrogen and then evacuate system to 500 microns. Hold for 30 minutes.
4. Break vacuum with refrigerant and charge per manufacturer's directions.

END OF SECTION 232300

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SECTION 233113

METAL DUCTWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract apply to this Section.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 23 Section "Duct Accessories" for flexible duct materials, dampers, duct-mounted access panels and doors, turning vanes, duct silencers, fabric ducts, pre-insulated outdoor ductwork, and turning vanes.
2. Division 23 Section "HVAC Insulation" for external duct and plenum insulation.
3. Division 23 Section "Diffusers, Registers, Grilles and Louvers."
4. Division 23 Section "Control Systems Equipment" for automatic volume control dampers and operators.
5. Division 23 Section "Testing, Adjusting, and Balancing."

1.02 SUMMARY

A. This Section includes rectangular and round metal ducts and plenums for heating, ventilating, and air conditioning systems in pressure classes from minus 4 inches to plus 10 inches water gage.

1.03 DEFINITIONS

A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:

1. Seams: A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.
2. Joints: Joints include girth joints; branch and subbranch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.04 SYSTEM PERFORMANCE REQUIREMENTS

A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Changes or alterations to the layout or configuration of the duct system must be specifically approved in writing. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original design results without increasing the system total pressure.

1.05 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data including details of construction relative to materials, dimensions of individual components, profiles, and finishes for the following items:

1. Duct Liner.
2. Sealing Materials.

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C. Shop drawings from duct fabrication shop, drawn to a scale not smaller than ¼-inch equals 1 foot, on drawing sheets same size as the Contract Drawings, detailing:
   1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
   2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust ducts systems, indicate the classification of the materials handled as defined in this Section.
   3. Fittings.
   4. Reinforcing details and spacing.
   5. Seam and joint construction details.
   6. Penetrations through fire-rated and other partitions.
   7. Terminal unit, coil, and humidifier installations.
   8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

D. Coordination drawings for ductwork installation in accordance with Division 23 Sections. In addition to the requirements specified, show the following:
   1. Coordination with ceiling suspension members.
   2. Spatial coordination with other systems installed in the same space with the duct systems.
   3. Coordination of ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
   4. Coordination with ceiling-mounted lighting fixtures and air outlets and inlets.

E. Welding certificates including welding procedures specifications, welding procedures qualifications test records, and welders' qualifications test records complying with requirements specified in "Quality Assurance" below.

F. Record drawings including duct systems routing, fittings details, reinforcing, support, and installed accessories and devices

G. Maintenance data for volume control devices, fire dampers, and smoke dampers.

1.06 QUALITY ASSURANCE

A. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" for hangers and supports and AWS D9.1 "Sheet Metal Welding Code."

B. Qualify each welder in accordance with AWS qualification tests for welding processes involved. Certify that their qualification is current.

C. NFPA Compliance: Comply with the following NFPA Standards:
   1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealant and fire-stopping materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle sealant materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

C. Deliver and store stainless steel sheets with mill-applied adhesive protective paper, maintained through fabrication and installation.

PART 2 - PRODUCTS

2.01 SHEET METAL MATERIALS

A. Sheet Metal, General: Provide sheet metal in thicknesses indicated, packaged and marked as specified in ASTM A 700.

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B. Galvanized Sheet Steel: Lock-forming quality, ASTM A 527, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.

C. PVC-Coated Galvanized Steel: UL-181 Class 1 Listing. Lock-forming quality galvanized sheet steel with ASTM A 527, Coating Designation G 90. Provide with factory-applied, 4-mil, PVC coating on the exposed surfaces of ducts and fittings (exterior of ducts and fittings for underground applications, and the interior of ducts and fittings for fume-handing applications) and 2-mil PVC coating on the reverse side of the ducts and fittings.

D. Carbon Steel Sheets: ASTM A 366, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.

E. Stainless Steel: ASTM A 480, Type 316, sheet form, with No. 3 finish on exposed surface for ducts exposed to view; Type 304, sheet form, with No. 1 finish for concealed ducts.

F. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish where ducts are exposed to view, and mill finish for concealed ducts.

G. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum and stainless steel ducts provide reinforcing of compatible materials.

H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.02 SEALING MATERIALS

A. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for class 1 ducts.

B. Joint and Seam Sealant: One-part, non-sag, solvent-release-curing, polymerized butyl sealant complying with FS TT-S-001657, Type I; formulated with a minimum of 75 percent solids.

C. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.03 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4 inches thick.

B. Hangers: Galvanized sheet steel, or round, zinc plated steel, threaded rod.
   1. Hangers Installed In Corrosive Atmospheres: Electro-galvanized, all-thread rod or hot-dipped-galvanized rods with threads painted after installation.
   2. Straps and Rod Sizes: Conform with Table 4-1 in SMACNA HVAC Duct Construction Standards, 1995 Edition, for sheet steel width and gage and steel rod diameters.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.
   1. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.
   2. For stainless steel ducts, provide stainless steel support materials.
   3. For aluminum ducts, provide aluminum support materials, except where materials are electrolytically separated from ductwork.

2.04 STATIC PRESSURE CLASSIFICATION

A. Static Pressure Classifications: Except where otherwise indicated, construct duct systems to the following pressure classifications:

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1. Low Pressure Exhaust Ducts: 1 inch water gage, negative pressure.
2. Medium Pressure Exhaust Ducts: 4 inches water gage, negative pressure

B. Cross-breaking or Cross Beading: Cross-break or bead duct sides that are 19 inches and larger and are 20 gage or less, with more than 10 sq. ft. of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standard," Figure 1-4, unless they are lined or are externally insulated.

2.05 ROUND AND FLAT OVAL DUCT SUPPLY AND EXHAUST FITTINGS FABRICATION

A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to conform to SMACNA "HVAC Duct Construction Standards," 1995 Edition, Figures 3-4 and 3-5 and with metal thicknesses specified for longitudinal seam straight duct.

B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from the body onto branch tap entrance.

C. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate the bend radius of die-formed, gored, and pleated elbows 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting the following requirements:

1. Mitered Elbows: Fabricate mitered elbows with welded construction in gages specified below.
   a. Mitered Elbows Radius and Number of Pieces: Unless otherwise indicated, construct elbow to comply with SMACNA "HVAC Duct Construction Standards," Table 3-1.
   b. Round Mitered Elbows: Spot welded and bonded with metal thickness listed below for pressure classes from minus 2 inches to plus 2 inches:
      1) 3 to 26 inches: 24 gage.
      2) 27 to 36 inches: 22 gage.
      3) 37 to 50 inches: 20 gage.
      4) 52 to 60 inches: 18 gage.
      5) 62 to 84 inches: 16 gage.
   c. Round Mitered Elbows: Spot welded and bonded with metal thickness listed below for pressure classes from 2 inches to 10 inches:
      1) 3 to 14 inches: 24 gage.
      2) 15 to 26 inches: 22 gage.
      3) 27 to 50 inches: 20 gage.
      4) 52 to 60 inches: 18 gage.
      5) 62 to 84 inches: 16 gage.
   d. Flat Oval Mitered Elbows: Spot welded and bonded with the same metal thickness as longitudinal seam flat oval duct.
   e. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material handling classes A and B; and only where space restrictions do not permit the use of 1.5 bend radius elbows. Fabricate with a single-thickness turning vanes.
2. Round Elbows - 8 Inches and Smaller: Die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 3-1/2- and 4-1/2-inch) elbows with gored construction.
3. Round Elbows - 9 Through 14 Inches: Gored or pleated elbows for 30, 45, 60, and 90 degrees, except where space restrictions require a mitered elbow. Fabricate nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 9-1/2- and 10-1/2-inch) elbows with gored construction.
4. Round Elbows - Larger Than 14 Inches and All Flat Oval Elbows: Gored elbows, except where space restrictions require a mitered elbow.
5. Die-Formed Elbows for Sizes Through 8 Inches and All Pressures: 20 gage with 2-piece welded construction.

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6. Round Gored Elbows Gages: Same as for non-elbow fittings specified above.
7. Flat Oval Elbows Gages: Same as longitudinal seam flat oval duct.
8. Pleated Elbows Sizes Through 14 Inches and Pressures Through 10 Inches: 26 gage.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION, GENERAL

A. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.
B. Install ducts with the fewest possible joints.
C. Use fabricated fittings for all changes in directions, changes in size and shape, and connections.
D. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.
E. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.
F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
G. Provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.
H. Install insulated ducts with 1-inch clearance outside of insulation.
I. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.
J. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
K. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
L. Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2 inches.
M. Low pressure supply duct takeoffs shall be equivalent to Crown 306 or equal by Flexmaster or United McGill. Medium pressure takeoffs shall be conical type.
N. Low pressure round duct runouts to supply diffusers may be "snap-lock" duct meeting the pressure classification.
O. Exposed round duct shall be medium pressure spiral duct with mill-phosphatized treatment. Prime and paint - color selected by the Design Professional.

3.02 SEAM AND JOINT SEALING

A. General: Seal duct seams and joints as follows:
1. Conditioned Spaces:
a. Supply duct pressure classification 2-inches water gage and greater and exhaust ducts: All transverse joints and longitudinal seams.
b. Supply duct pressure classification less than 2-inches water gage and all return duct: All transverse joints and longitudinal seams.
c. Return and Exhaust Duct: Al transverse joints and longitudinal seams.

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2. Unconditioned Spaces:
    a. Supply duct pressure classification 2-inches water gage and greater: All transverse joints, longitudinal seams, and duct wall penetrations.
    b. Supply duct pressure classification less than 2-inches water gage and all return duct: All transverse joints, and longitudinal seams.
    c. Return and Exhaust Duct: All transverse joints.
3. Outdoor Spaces:
    a. All supply and return duct: All transverse joints, longitudinal seams, and duct wall penetrations.
    b. Exhaust Duct: All transverse joints.

B. Solvent based sealant shall only be used in applications where freezing may occur before sealant is cured. Water-based sealant shall be used in all other applications.

C. Seal externally insulated ducts prior to insulation installation.

D. All duct sealing shall be in accordance with ASHRAE standard 90.1.

3.03 HANGING AND SUPPORTING

A. Install rigid round, rectangular, and flat oval metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards," Chapter 5.

B. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.

C. Support vertical ducts at a maximum interval of 16 feet and at each floor.

D. Upper attachments to structures shall have an allowable load not exceeding 1/4 of the failure (proof test) load but are not limited to the specific methods indicated.

E. Install concrete insert prior to placing concrete.

F. Install powder actuated concrete fasteners after concrete is placed and completely cured.

3.04 CONNECTIONS

A. Equipment Connections: Connect equipment with flexible connectors in accordance with Division 23 Section "Duct Accessories."

B. Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figures 2-7 and 2-8.

C. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figures 2-16 through 2-18.

D. Low pressure round supply duct takeoffs shall be equivalent to Crown 306 adjustable 45 degree takeoff. Other acceptable manufacturers include, but are not limited to, Flexmaster and United McGill.

3.05 FIELD QUALITY CONTROL

A. Disassemble, reassemble, and seal segments of the systems as required to accommodate leakage testing, and as required for compliance with test requirements.

B. All ductwork shall be approved by the Design Professional prior to the application of external insulation. In the absence of such approval, smoke testing, pressure testing or other leakage testing of ductwork shall be required.

C. Conduct duct pressure tests in the presence of the Design Professional after the testing has demonstrated that the duct system meets the stated leakage criteria.

D. Determine leakage from entire medium pressure system or section of the system by relating leakage to the total system airflow capacity.

E. The following systems shall be pressure tested in accordance with SMACNA's HVAC Air Duct Leakage Test Manual, and meet the stated criteria:
    1. Low pressure return and exhaust ductwork: test at 1.0 inches water column static pressure, with a maximum leakage of 1%.

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F. Do not pressurize systems above the maximum design operating pressure (static pressure classification.) Give 7 days' advanced notice for testing.

G. Remake leaking joints as required and apply sealants to achieve specified maximum allowable leakage. Integrity of ductwork shall be approved by the Design Professional prior to application of insulation.

3.06 ADJUSTING AND CLEANING

A. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Division 23 Section "TESTING, ADJUSTING, AND BALANCING" for requirements and procedures for adjusting and balancing air systems.

B. Vacuum ducts systems prior to final acceptance to remove dust and debris.

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SECTION 233300

DUCT ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Backdraft dampers.
   2. Duct-mounted access doors and panels.
   3. Flexible connectors.
   4. Flexible ducts.
   5. Accessories hardware.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data including details for materials, dimensions of individual components, profiles, and finishes for the following items:
   1. Backdraft dampers.
   2. Duct-mounted access panels and doors.
   3. Flexible ducts.

C. Shop drawings from manufacturer detailing assemblies. Include dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail the following:
   1. Special fittings and volume control damper installation (both manual and automatic) details.
   2. Fire and smoke damper installations, including sleeves and duct-mounted access door and panel installations.

D. Product Certification: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static pressure loss, and dimensions and weights.

E. Maintenance data for volume control devices, fire dampers, and smoke dampers.

1.04 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA Standards:
   1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
   2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

1.05 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: A written warranty, executed by the manufacturer and signed by the Contractor, agreeing to replace components that fail in materials or workmanship, within the specified warranty period, provided manufacturer's written instructions for installation, operation, and maintenance have been followed.

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1. Warranty Period, Fabric Duct: Manufacturer's standard but not less than 10 years for fabric components of the system.
2. Warranty Period, pre-insulated, outdoor ductwork: Manufacturer's standard but not less than 10 years for all system components.

1.06 DELIVERY, STORAGE AND HANDLING (FABRIC DUCT)

A. Protect fabric air dispersion systems from damage during shipping, storage and handling.

B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

PART 2 - PRODUCTS

2.01 BACKDRAFT DAMPERS

A. Description: Suitable for horizontal or vertical installation.

B. Frame: 18-gage galvanized steel, with welded corners and mounting flange.

C. Blades: 0.025-inch-thick roll-formed aluminum.

D. Blade Seals: Neoprene.

E. Blade Axles: Galvanized steel.

F. Tie Bars and Brackets: Galvanized steel.

G. Return Spring: Adjustable tension.

H. Chain Operator: 15-foot long galvanized-steel sash chain and pulley.

I. Wing-Nut Operator: Galvanized steel, with 1/4-inch galvanized-steel rod.

2.02 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. General: Provide construction and airtightness suitable for duct pressure class.

B. Frame: Galvanized sheet steel. Provide with bend-over tabs and foam gaskets.

C. Door: Double-wall, galvanized sheet metal construction with insulation fill and thickness, number of locks as indicated for duct pressure class. Provide vision panel where indicated. Provide cam latches.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber seals.

E. Insulation: 1-inch-thick fiber glass or polystyrene foam board.

2.03 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL Standard 181, Class 1.

B. Standard Metal-Edged Connectors: Factory-fabricated with a strip of fabric 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 24-gage, galvanized sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Standard, 3rd Edition, Figure 7-8.

C. Conventional, Indoor System Flexible Connectors Fabric: Glass fabric double coated with polychloroprene.
1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

2.04 FLEXIBLE DUCTS

A. General: Comply with UL 181, Class 1.

B. Flexible Ducts - Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch-thick, glass fiber insulation around a continuous inner liner.
1. Reinforcement: Steel-wire helix encapsulated in the inner liner.
2. Outer Jacket: Glass-reinforced, silver mylar.
3. Inner Liner: Polyethylene film.

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4. Pressure Rating: 10-inches wg, positive.
5. R value: 6.0

2.05 ACCESSORIES HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket and a flat mounting gasket. Size to allow insertion of pitot tube and other testing instruments and provide in length to suit duct insulation thickness.

B. Splitter Damper Accessories: Zinc-plated damper blade bracket, 1/4-inch, zinc-plated operating rod, and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Flexible Duct Clamps: Stainless steel band with cadmium-plated hex screw to tighten band with a worm-gear action. Provide in sizes from 3 to 18 inches to suit duct size.

D. Adhesives: High strength, quick setting, neoprene based, waterproof and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of duct accessories. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install duct accessories according to manufacturer's installation instructions and applicable portions of details of construction as shown in SMACNA standards.

B. Install volume control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated.

D. Install fire and smoke dampers according to the manufacturer's UL-approved printed instructions.

E. Install fusible links in fire dampers.

F. Label access doors according to Division 23 Sections.

3.03 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

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SECTION 233423

POWER AND GRAVITY VENTILATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Ceiling-mounted ventilators.

1.03 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on actual site elevations.
B. Project Altitude: Base air ratings on sea-level conditions.
C. Operating Limits: Classify according to AMCA 99.
D. Fan Unit Schedule: The following information is described in an equipment schedule on the Drawings.
   1. Fan performance data including capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
   2. Fan arrangement including wheel configuration, inlet and discharge configurations, and required accessories.

1.04 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.
B. Product Data including rated capacities of each unit, weights (shipping, installed, and operating), furnished specialties, accessories, and the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound power ratings.
   3. Motor ratings and electrical characteristics plus motor and electrical accessories.
   4. Material gages and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
C. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.
D. Coordination Drawings, according to Division 23 Section "Basic Mechanical Requirements," for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:
   1. Roof framing and support members relative to duct penetrations.
   2. Ceiling suspension assembly members.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
E. Wiring diagrams detailing wiring for power and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.
F. Maintenance data for power ventilators to include in the operation and maintenance manual.

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1.05 QUALITY ASSURANCE

A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

B. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

C. AMCA Compliance: Provide products that meet performance requirements and are licensed to use the AMCA Seal.

D. NEMA Compliance: Provide components required as part of fans that comply with applicable NEMA standards.

E. UL Standard: Provide power ventilators that comply with UL 705.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements. Verify clearances.

B. Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and fans have been commissioned.

1.07 COORDINATION AND SCHEDULING

A. Coordinate the size and location of structural steel support members.

B. Coordinate the installation of roof curbs, equipment supports, and roof penetrations.

1.08 EXTRA MATERIALS

A. Furnish one set of belts for each belt-driven fan that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme
2. Barry Blower
3. Berner
4. Broan Mfg. Co., Inc.
5. Carnes Co.
6. Central Blower Co.
7. Cincinnati Fan & Ventilator Co.
8. Cook (Loren) Co.
9. Essick Air Products, Breidert.
10. Greenheck Fan Corp.
11. Hartzell
12. ILG Industries, Inc.
13. Jenn Industries Inc.
14. Lau Division Philips Industries, Inc.
15. Mars
16. Penn
17. Twin City

2.02 CEILING-MOUNTED VENTILATORS

A. Description: Centrifugal fans designed for installing in ceiling or wall, or for concealed in-line applications.

B. Housing: Galvanized steel.

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C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
D. Grille (Ceiling Mounted): Aluminum grille with baked enamel finish. Furnish in-line configuration where indicated.
E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in. (Integral disconnect device.)
F. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.
G. Accessories: Manufacturer's standard roof jack or wall cap, and transition fittings where indicated on the drawings.

2.03 MOTORS
A. Refer to Division 23 Section "Common Motor Requirements for HVAC Equipment" for general requirements for factory-installed motors.
B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B. Furnish premium efficiency motors for all above 1 horsepower.
C. Enclosure Type: The following features are required as indicated:
1. Open drip-proof motors where satisfactorily housed or remotely located during operation.
2. Guarded drip-proof motors where exposed to contact by employees or building occupants.

2.04 FACTORY FINISHES
A. Sheet Metal Parts: Prime coat before final assembly.
B. Exterior Surfaces: Baked-enamel finish coat after assembly.
C. Aluminum Parts: No finish required.

2.05 SOURCE QUALITY CONTROL
A. Testing Requirements: The following factory tests are required as indicated:
1. Sound Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA Seal.
2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine areas and conditions for compliance with requirements of installation tolerances and other conditions affecting performance of the power ventilators. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION
A. Install power ventilators according to manufacturer's written instructions.
B. Support units using the vibration-control devices indicated. Vibration-control devices are specified in Division 23 Sections.
1. Support utility set fans on concrete housekeeping bases or roof supports using neoprene pads. Secure units to anchor bolts installed in housekeeping base.
2. Support utility set fans on concrete housekeeping bases or roof supports using housed spring isolators. Secure units to anchor bolts installed in housekeeping base.
3. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. Furnish a minimum of one screw per side of the curb.

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4. Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.
5. Ceiling Units: Suspend units from structure using steel wire or metal straps.

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 23.

3.03 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

B. Electrical: Conform to applicable requirements in Division 26 Sections.

C. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of fans, including duct and electrical connections, and to report results in writing.

3.05 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.06 CLEANING

A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

B. Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

3.07 COMMISSIONING

A. Final Checks before Startup: Perform the following operations and checks before startup:
1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections for piping, ducts, and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in the fully open position.
7. Disable automatic temperature-control operators.

B. Starting procedures for fans are as follows:
1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
2. Measure and record motor voltage and amperage.

C. Shut unit down and reconnect automatic temperature-control operators.

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D. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.
E. Replace fan and motor pulleys as required to achieve design conditions.

3.08 DEMONSTRATION

A. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
B. Review data in the operation and maintenance manuals.
C. Schedule training with Owner, through the Design Professional, with at least 7 days' advance notice.
D. Demonstrate operation of power ventilators.

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SECTION 233713

LOUVERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY
A. This Section includes wall-mounted louvers.

1.03 DEFINITIONS
A. Louver: Exterior wall air device which resists the penetration of rain.

1.04 SUBMITTALS
A. Product Data: For each model indicated, include the following:
1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
3. Schedule of louvers indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.
B. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.

1.05 QUALITY ASSURANCE
A. Product Options: Drawings and schedules indicate specific requirements louvers and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered.
B. NFPA Compliance: Install louvers according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS
A. Acceptable manufacturers shall be:
1. Anemostat Products
2. Arrow
3. Carnes Co.
4. Greenheck
5. Hart and Cooley
6. Tuttle and Bailey
7. Krueger
8. J&J
9. Nailor
10. Titus
11. Metal*Aire
12. Vent Products
13. Price
14. Dowco
15. Ruskin

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B. All exterior louvers shall be 6-inches deep.

2.02 SOURCE QUALITY CONTROL

A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where louvers are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install louvers level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Install louvers with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

A. After installation, adjust louvers to air patterns indicated, or as directed, before starting air balancing.

3.04 CLEANING

A. After installation of louvers, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges.

END OF SECTION 233713

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SECTION 238126

SPLIT SYSTEM HEAT PUMPS AND AIR CONDITIONERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY
- A. This Section includes split system heat pump units and related components.

1.03 SUBMITTALS
- A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities of selected model clearly indicated; dimensions; required clearances; shipping, installed, and operating weights; furnished specialties; accessories; and installation and startup instructions.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.
  1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
  2. Refrigerant piping schematics showing sizes and accessories.
- C. Commissioning Reports: Indicate results of startup and testing commissioning requirements. Submit copies of checklists.
- D. Maintenance Data: For equipment to include in the maintenance manuals.
- E. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE
- A. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- B. Energy Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- C. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- D. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.
  1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
- E. Comply with NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Deliver indoor and outdoor units as factory-assembled units with protective crating and covering.
- B. Coordinate delivery of units in sufficient time to allow movement into building.
- C. Handle units to comply with manufacturer's written rigging and installation instructions for unloading and moving to final location.

1.06 COORDINATION
- A. Coordinate installation of concrete pads and equipment supports

1.07 WARRANTY
- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

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B. Special Warranty: A written warranty, executed by the manufacturer and signed by the Contractor, agreeing to replace components that fail in materials or workmanship, within the specified warranty period, provided manufacturer's written instructions for installation, operation, and maintenance have been followed.
   1. Warranty Period, Compressors: Manufacturers standard, but not less than 5 years after date of Material Completion.

1.08 EXTRA MATERIALS
A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Filters: Three sets of filters for each unit.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ductless Split Systems:
      a. Carrier Corp.
      b. Daikin
      c. Mitsubishi
      d. Trane

2.02 DUCTLESS SPLIT SYSTEMS
A. Provide a split system heat pump and air conditioning units utilizing outdoor condenser and indoor evaporator connected by copper refrigerant tubing with flare type fittings. Outdoor unit shall contain sufficient R-410a to charge complete system. The condenser shall be equipped with an inverter-driven compressor and external brass service valves and charging port. Indoor unit shall be equipped with electric resistance back-up heater (where indicated.) The outdoor condenser shall have a capillary tube metering device located internally. Evaporator and condenser coils shall be constructed with aluminum fins mechanically bonded to copper tubes. The system shall bear the ARI Certification symbol.
B. Indoor unit shall be mounted as indicated on the Drawings. Controls shall be integral type IC thermostat with settings for multiple speeds and automatic position, 12 hour timer with ON/OFF settings, night set-back and energy saver position. Furnish hard-wired remote-control panel. Cooling and heating capacities and electrical characteristics shall be as shown on the Drawings. Supplemental electric resistance heat shall be provided where indicated.
C. Provide disconnect device for indoor unit when power is supplied by outdoor unit. Furnish low ambient controls and condenser coil guards unless indicated otherwise.

2.03 DEHUMIDIFIERS:
A. Dehumidifier shall be a self-contained unit with integral rotary compressor, cooling and condenser coils. Unit shall have panel-mounted on-off switch and dehumidistat. Furnish capability to attach permanent piped drain.

2.04 REFRIGERANT PIPE SIZE
A. Pipe sizes shown on the drawings are for estimating purposes only. Final pipe sizes shall be selected by the manufacturer and shall be included in the submittal data. Accessories (larger crankcase heaters, liquid line solenoid valve, oversize suction accumulators, wind baffles, etc.) required or recommended by the equipment manufacturer shall be provided at no additional cost.

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2.05 EMERGENCY DRAIN PAN:

A. Provide 22 gauge galvanized emergency drain pan under all air handling units having water or drain connections. Drain pan shall extend 6" beyond unit on all sides, shall have 2" high hemmed sides. All seams and joints shall be soldered liquid tight. Exception: Emergency drain pans are not required for slab-on-grade equipment.

B. Furnish float switch in the emergency drain pan which de-energized the associated HVAC system when moisture is present.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine installation locations for compliance with requirements for conditions affecting installation and performance of units. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install units according to manufacturer's written instructions.

B. Furnish float switch for unit shutdown interlock.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping to allow service and maintenance.

B. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. Furnish flexible connections at all unit connections.

C. Electrical: Conform to applicable requirements in Division 26 Sections.

D. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 COMMISSIONING

A. Verify that installation is as indicated and specified.

B. Complete manufacturer's installation and startup checks and perform the following:

1. Level unit on support structure.
2. Inspect for visible damage to unit casing.
3. Inspect for visible damage to compressor, air-cooled condenser coil, and fans.
4. Verify that clearances have been provided for servicing.
5. Check that labels are clearly visible.
6. Verify that controls are connected and operable.
7. Remove shipping bolts, blocks, and tie-down straps.
8. Verify that filters are installed.
9. Adjust vibration isolators.
10. Check acoustic insulation.

C. Lubricate bearings on fan.

D. Check fan-wheel rotation for correct direction without vibration and binding.

E. Adjust fan belts to proper alignment and tension.

F. Start unit according to manufacturer's written instructions.

1. Perform starting of refrigeration in summer only.
2. Complete startup sheets and attach copy with Contractor's startup report.

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G. Check and record performance of interlocks and protection devices; verify sequences.
H. Operate unit for an initial period as recommended or required by manufacturer.
I. Calibrate thermostats.
J. Check internal isolators.
K. Check controls for correct sequencing of heating, refrigeration, and normal and emergency shutdown.
L. Simulate maximum cooling demand and check the following:
    1. Compressor refrigerant suction and hot-gas pressures.
    2. Short circuiting air through condenser or from condenser to outside-air intake.
M. After starting and performance testing, change filters, vacuum heat exchanger and cooling and condenser coils, lubricate bearings and adjust belt tension.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
    1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
    2. Review data in the maintenance manuals.
    3. Schedule training with Owner, through the Design Professional, with at least 7 days' advance notice.
    4. Provide letter from factory service representative stating that equipment is installed and operating as per manufacturer’s recommendations.

END OF SECTION 238126

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SECTION 238239

UNIT HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY
A. This Section includes unit heaters and cabinet unit heaters.

1.03 SUBMITTALS
A. General: Submit each item in this Article according to the Conditions of the Contract.
B. Product data for each type of product specified.
C. Wiring diagrams detailing power and control wiring and differentiating clearly between manufacturer-installed wiring and field-installed wiring.
D. Samples of cabinet finish colors for approval.
E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Design Professionals and owners, and other information specified.
F. Field test reports from a qualified independent inspecting and testing agency indicating and interpreting test results relative to compliance with performance requirements of unit heaters.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Firm experienced in manufacturing unit heaters similar to those indicated for this Project and that have a record of successful in-service performance.
B. Comply with NFPA 70 for components and installation.
C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

1.05 EXTRA MATERIALS
A. Furnish the following extra materials, matching products installed, packaged with protective covering for storage and with identification labels clearly describing contents.
B. Cabinet Unit Heater Filters: Furnish three spare filters for each filter installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide unit heaters by one of the following:
1. Brasch Manufacturing Co., Inc.
2. Carrier Corp.
3. Lennox Industries Inc.
4. Markel Products Company.
5. Marley Electric Heating Company; Berko Division.
6. Sterling Radiator Division/Mestek, Inc.

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7. Trane Co.
8. Marley Electric Heating Company; Q-Mark Division.
9. Indeeco
10. Raywall

2.02 ELECTRICAL CABINET UNIT HEATERS

A. Description: Surface-mounting cabinet with front grille air inlet and front air outlet.

B. Heating Elements: Nickel-chromium heating wire element; free from expansion noise and 60-Hz hum; embedded in magnesium oxide, insulating refractory; and sealed in high-mass steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends are enclosed in terminal box. Fin surface temperature does not exceed 550 deg F at any point during normal operation.

C. Heater Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for overtemperature protection of heaters.

D. Fan and Motor: Centrifugal blower, direct driven by a single-phase, 2-speed electric motor with inherent overload protection and resilient motor/fan mount.

E. Wiring Terminations: Match conductor materials and sizes indicated.

F. Filter: Manufacturer's standard throwaway filter, 1 inch thick, on inlet of each fan.

G. Unit Controls: Thermostat, fan-speed switch, fan ON-AUTOMATIC switch, night-setback relay, interval timer, and outside air-damper control switch.

H. Optional Accessories: Include the following:
1. Timer switch.
2. Wall thermostat.
3. Outside air damper and duct collar, adjustable to 50 percent outside air.
4. Disconnect switch.
5. Mercury contactor.
6. Fan-delay relay.

I. Cabinet finish suitable for field-applied paint.

J. Finish cabinet with manufacturer's standard enamel, color as selected by Design Professional.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and supports to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of units. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install unit heaters as indicated, according to manufacturer's written instructions and NFPA 90A.

B. Connect unit heaters and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.

3.03 FIELD QUALITY CONTROL

A. Testing: After installing unit heaters and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

B. Remove and replace malfunctioning units with new units and retest.

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3.04 CLEANING

A. Replace filters in each cabinet unit heater.

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SECTION 26 0000

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SUMMARY

A. This Division of the specifications (260000) covers the complete interior and exterior electrical system for all work shown on the drawings as specified herein providing all material, labor and equipment required for the installation of the electrical systems complete and in operating condition.
B. Include in the electrical work all the necessary supervision and the issuing of all coordinating information to any other trades who are supplying work to accommodate the electrical installations.
C. Submittal, Record Drawing and Operation and Maintenance Manual Procedures.

1.02 SUBMITTALS REQUIRED

A. Equipment connection coordination letter.
B. Utility Provider(s) coordination letters.

1.03 COORDINATION

A. This Contractor shall schedule his work and, in every way, possible cooperate with all other Contractors on the job to avoid delays, interferences, and unnecessary work. He shall notify them of all openings, hangers, excavations, etc., so that proper provisions shall be made for his work. This shall not relieve him of the cost of cutting, when such is required.
B. This Contractor shall do all cutting and excavating necessary for the complete installation of his work, but he shall not cut the work of any other Contractor without first consulting the Architect. He shall repair any work damaged by him or his workmen, employing the services of the Contractor whose work is damaged. Saw cut existing slab as required for routing conduits and floor boxes noted to be installed in existing floors. Restore to original finish.
C. This Contractor shall by all means coordinate the location of ceiling lighting fixtures, both recessed and surface mounted, with the Ceiling Contractor so that proper hangers and supports shall be provided.
D. Any conflict between electrical and other trades shall be reported before construction starts. No extra charges will be approved for work resulting from failure to coordinate with other trades.
E. Coordinate arrangement, mounting, and support of electrical equipment:

    1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
    2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
    3. To allow right of way for piping and conduit installed at required slope.
    4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

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F. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
G. Coordinate sleeve selection and application with selection and application of fire stopping.

1.04 DRAWINGS

A. The drawings for electrical work utilize symbols and schematic diagrams which have no dimensional significance. The work shall therefore, be installed to fulfill the diagrammatic intent expressed on the electrical drawings.
B. Review architectural drawings for door swings, cabinets, counters, moldings and built-in equipment, conditions indicated on architectural drawings shall govern. Prior to rough-in of receptacles and systems outlets refer to architectural casework drawings for rough-in coordination.
C. Coordinate electrical work with the architectural details, floor plans, elevations, structural and mechanical drawings. Provide fittings, junction boxes and accessories to meet conditions.
D. Do not scale drawings. Dimensions for layout of equipment, or spaces shall be obtained from architectural, structural or mechanical drawings unless specifically indicated on the electrical drawings.
E. Discrepancies shown on different drawings, between drawings and specifications or between drawings and field conditions shall be promptly brought to the attention of the Architect.
F. Provide as used on the drawings and in the specifications shall mean, furnish, install, connect, adjust and test.
G. The drawings and specifications are complimentary and any work or material shown in one and omitted in the other, or described in the one and not shown in the other, or which may be implied by both or either, shall be furnished as though shown on both, in order to give a complete and first class installation.

1.05 CODES AND PERMITS:

A. All electrical work shall meet or exceed the latest requirements of the following codes and/or other authorities exercising jurisdiction over the electrical construction work and the project.

    1. The National Electrical Code (NFPA 70) - 2017 Edition
    2. The National Electrical Safety Code (ANSI C-2)
    3. The Life Safety Code (NFPA 101) - Georgia - 2018 Edition
    4. The International Building Code - 2018 Edition
    5. Regulations of the local utility company with respect to metering and service entrance.
    6. Municipal and State ordinances governing electrical work.

B. All required permits and inspection certificates shall be obtained, and made available at the completion of the work. Permits, inspections, and certification fees shall be paid for as a part of the electrical work.

1.06 EQUIPMENT CONNECTIONS:

A. All equipment requiring electrical power connections shall be connected under this Division of these specifications.

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B. Where electrical connections to equipment require specific locations, such locations shall be obtained from shop drawings.
C. Drawings for location of conduit stub-up boxes mounted in wall or floor to serve specific equipment shall not be scaled.
D. Electrical circuits to equipment furnished under other sections of these specifications are based on design loads. If actual equipment furnished has loads other than design loads electrical circuits and protective devices shall be revised to be compatible with equipment furnished at no additional cost to the Owner. Any revisions must have prior approval by the Architect.
E. Before submitting shop drawings, Electrical Sub-Contractor shall along with the Mechanical and Plumbing Sub-Contractor review voltage and load requirements for mechanical and plumbing equipment to determine the compatibility between what is being furnished and what is shown in the contract drawings. The Electrical Sub-Contractor shall along with his submittals submit a statement that he has reviewed all shop drawings including review with the Mechanical and Plumbing Sub-Contractors.
F. Where equipment is indicated to be served thru conduit stub-up, conduit shall be stubbed up not less than four inches above floor where transition shall be made to sealtite flexible conduit for connection to equipment.
G. The Contractor's attention is invited to other Divisions of these specifications, where equipment requiring electrical service or electrically related work is specified to become fully aware of the scope of work required for electrical service or related work.
H. Where electricity utilizing equipment is supplied separate from the electrical work, and is energized, controlled or otherwise made operative by electrical work, the testing to provide the proper functional performance of such wiring systems shall be conducted by the trade responsible for the equipment. The electrical work shall, however, include cooperation in such testing and the making available of any necessary testing or adjustments to the electrical equipment.
I. Heating, air conditioning, and ventilating equipment is specified to be furnished and installed under other sections of these specifications. The controls likewise are specified to be furnished there under. All necessary wiring, wiring troughs and circuit breakers for power for this equipment shall be furnished and installed under this section of the specifications, in accordance with the plans and/or diagrams furnished with the equipment, or shown on these plans. Starters furnished by the Mechanical Contractor shall be installed under this Division of the specifications. Power wiring to auxiliary equipment on a piece of equipment remote from its main terminal box and interlocking of apparatus shall be accomplished under Heating Ventilating Equipment section of the specifications. Conduit and outlets for control wiring shall be furnished and installed under Division 23 of these specifications. Control conductors for mechanical equipment shall not be installed in same conduit with power conductors.
J. Contractor is to note that location of disconnect switches shown are schematic in nature. Exact location of disconnect switch and mounting height shall be coordinated with field conditions and equipment shop drawings. Locate disconnect as required to maintain clearances required by National Electrical Code.

1.07 GUARANTEE:

A. Defective lamps shall be replaced up-to-date of acceptance and shall be guaranteed for entire length of warranty as specified by the Architect.
B. All systems and component parts shall be guaranteed entire length of warranty as specified by the Architect from the date of final acceptance of the complete project.

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Defects found during this guaranteed period shall be promptly corrected at no additional cost to the Owner.

1.08 PRODUCT DATA, SAMPLES AND SHOP DRAWINGS SUBMITTAL PROCEDURE

A. See Division 26 – Electrical Submittal Procedures specification section.

1.09 RECORD DRAWINGS:

A. One complete set of electrical drawings shall be reserved for as-built drawings. Any approved deviation from the contract drawings shall be recorded on these drawings. Drawings shall be checked monthly for completeness.
B. Completed as-built drawings shall be presented to the Architect prior to final inspection.

1.10 MAINTENANCE AND OPERATING INSTRUCTIONS:

A. Provide at the time of final inspection three sets of maintenance and operating instruction for:
   1. Lighting and Power Panelboards
   2. Fuses
   3. Wiring Devices
   4. Lighting Fixtures
   5. Disconnect Switches
   6. Transformers
   7. Lighting Control Devices System
   8. Fire Alarm System
   9. Exterior Athletic Lighting
   10. Surge Protection System
   11. Data/Voice Network Cabling System
   12. Performance Sound Systems
   13. Surveillance Camera System
   14. Intrusion System
B. Furnish a qualified and accredited factory trained technician to train personnel designated by the Owner in the proper operation and maintenance of specialized equipment.
C. The issuing of operating instructions shall include the submission of the name, address, and telephone number of the manufacturer's representative and service company for each item of equipment so that service and spare parts can be readily obtained.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Materials specified by manufacturer's name shall be used unless approval of other manufacturers is listed in addenda to these specifications.
B. Drawings indicating proposed layout of space, all equipment to be installed therein and clearance between equipment shall be submitted, where substitution of materials alter space requirements on the drawings.
C. Material Standards: All materials shall be new and shall conform to the standards where such have been established for the particular material in question.

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Publications and Standards of the organization listed below are applicable to materials specified herein.

1. American Society for Testing and Materials (ASTM)
2. Underwriter's Laboratories, Inc. (UL)
3. National Electrical Manufacturer Association (NEMA)
4. Insulated Cable Engineers Association (ICEA)
5. Institute of Electrical and Electronic Engineers (IEEE)
6. National Fire Protection Association (NFPA)
7. American National Standards Institute (ANSI)

D. Material of the same type shall be the product of one manufacturer.
E. Materials not readily available from local sources shall be ordered immediately upon approval.
F. The Architect shall have authority to reject any materials, or equipment, not complying with these specifications and have the Contractor replace materials so rejected immediately upon notification of rejection.
G. Any material or equipment so rejected shall be removed from the job within 24 hours of such rejection; otherwise the Architect may have same removed at the Contractor's expense.

2.02 PRODUCT DELIVERY, STORAGE, HANDLING, & PROTECTION

A. Inspect materials upon arrival at Project and verify conformance to Contract Documents. Prevent unloading of unsatisfactory material. Handle materials in accordance with manufacturer's applicable standards and suppliers recommendations, and in a manner to prevent damage to materials. Store packaged materials in original undamaged condition with manufacturer's labels and seals intact. Containers which are broken, opened, damaged, or watermarked are unacceptable and shall be removed from the premises.
B. All material, except items specifically designed to be installed outdoors such as pad mounted transformers or stand-by generators, shall be stored in an enclosed, dry building or trailer. Areas for general storage shall be provided by the Contractor. Provide temperature and/or humidity control where applicable. No material for interior installation, including conductors, shall be stored other than in an enclosed weather tight structure. Equipment stored other than as specified above shall be removed from the premises.
C. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Conditions shall be those for which the equipment or materials are designed to be installed. Equipment and materials shall be protected from water, direct sunlight, cold or heat. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.
B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

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C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
E. Right of Way: Give to piping systems installed at a required slope.
F. Raceways, fixtures, devices, and other electrical equipment shall be installed in a neat and workmanlike manner.
G. The Architect or his representative shall have the authority to reject any workmanship not complying with the contract documents.
H. The Electrical Contractor shall personally or through an authorized licensed and competent electrician, constantly supervise the work from beginning to complete and final inspection.
I. Electrical equipment shall be installed in accordance with manufacturer's recommendations.
J. Locations of proposed raceway, riser, location of structural elements, location and size of chases method and type of construction of floors, walls, partitions, etc., shall be verified before construction starts.
K. Consult owner and utility companies for underground lines before any underground work is started. Contractors shall be responsible for any damage.
L. All empty conduits shall have a pull string installed. All flush recessed boxes shall have blank plates installed.

3.02 CLEANING AND PAINTING

A. Remove oil, dirt, grease and foreign materials from all raceways, fittings, boxes, panelboard trims and cabinets to provide a clean surface for painting. Touch-up scratched or marred surfaces of lighting fixtures, panelboard and cabinet trims, motor control center, switchboard or equipment enclosures with paint furnished by the equipment manufacturers specifically for that purpose.
B. Do not paint trim covers for flush mounted panelboards, telephone cabinets, pull boxes, junction boxes and control cabinet unless required by the Architect. Remove trim covers before painting. Under no conditions shall locks, latches or exposed trim clamps be painted.
C. Unless indicated on the drawings or specified herein to the contrary, all painting shall be done under the PAINTING Section of these Specifications.
D. Where plywood backboards are used to mount equipment provided under Division 26, paint backboards with two coats of light grey semi-gloss paint. Plywood shall be 3/4" fire rated plywood. Paint shall be fire retardant paint.

3.03 SERVICE:

A. The electrical service and telephone/CATV service for this project has been coordinated between the Engineer and the Utility Company. However, before installing service conduit (underground or mast), Contractor shall contact Utility Company and verify voltage, location and type of service. Prior to rough-in, coordinate an on-site meeting with each Utility Company to review exact requirements. Submit letter of coordination to Engineer for review.

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B. Where contract documents show a pad mount transformer provide by Utility Company, the following items shall be coordinated with Civil Plans, Architectural Plans, and Utility Company prior to rough-in.

1. Transformer pad locations shall be a minimum of 10'-0" from any building overhangs, canopies, exterior walls, balcony, exterior stairs and or walkways connected to the building.
2. Transformer pad edge shall be no less than 14'-0" from any door way.
3. Transformer pad edge shall be no less than 10'-0" from any windows or other openings.
4. If the building has an overhang, the 10'-0" clearance shall be measured from a point below the edge of the overhang only if the building is three (3) stories or less. If the building is four (4) stories or more, 10'-0" shall be measured from the outside building wall.
5. Fire escapes, outside stairs, and covered walkways attached to or between buildings, shall be considered part of the building.

    a. Note: This information above has been obtained from the NFPA Section 450-27 and the
    Office of Insurance and Safety Fire Commissioner Chapter 120-3-3.

6. If required by Utility Company, Contractor shall provide concrete pad for transformer per Utility Company requirements.
7. Contractor shall install meter (provided by Utility Company) on a 6" channel iron set in concrete. Paint channel iron to match transformer. Install 1 ¼" galvanized rigid steel conduit from meter to transformer C.T. compartment.
8. Install a 1 1/4" galvanized rigid steel conduit from meter and stubbed up into Main Electrical Room for future energy management monitoring. Install pull string and cap conduit.

3.04 DEVIATIONS:

A. No deviations from the plans and specifications shall be made without the full knowledge and consent of the Architect or his authorized representative.
B. Should the Contractor find at any time during progress of the work that, in his judgment, existing conditions make desirable a modification in requirements covering any particular item or items, he shall report such items promptly to the Architect for his decision and instruction.

3.05 EXCAVATION, TRENCHING AND BACKFILLING:

A. General. The Contractor shall perform all excavation to install conduit structures and equipment specified in this Division of the Specifications. During excavation, materials for backfilling shall be piled back from the banks of the trench to avoid over-loading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and other excavations and water accumulating therein shall be removed by pumping. All excavations shall be made by open cut. No tunneling shall be done. All requirements of OSHA shall be complied with.
B. Trench Excavation. The bottom of the trenches shall be graded to provide uniform bearing and support for each section of the conduit on undisturbed soil at every point along its entire length. Over depths shall be backfilled with loose, granular, moist

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earth, tamped. Removed unstable soil that is not capable of supporting the conduit and replace with specified material.

C. Backfilling. The trenches shall not be backfilled until it is reviewed by the Architect or his representative. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, and gravel or soft shale, free from large clods of earth or stones, deposited in 6" layers and tamped until the conduit has a cover of not less than the adjacent existing ground but not greater than 2" above existing ground. The backfilling shall be carried on simultaneously on both sides of the trench so that conduit is not displaced. The compaction of the filled trench shall be at least equal to that of the surrounding undisturbed material, except that trenches occurring under paved areas or in areas to be filled shall be backfilled in 6" maximum layers and each layer compacted to 95% maximum density. Settling the backfill with water will not be permitted. Any trenches not meeting compaction requirements or where settlement occurs shall have backfill removed down to the top of the conduit then backfill with approved materials as specified hereinbefore.

D. Positively no tree roots are to be damaged, hand dig where required. Damaged trees or shrubbery shall be replaced in kind and must be approved by Engineer.

3.06 FIRESTOPPING

A. Apply fire stopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

3.07 CONSTRUCTION REVIEWS

A. The Architect or his representative shall observe and review the installation of all electrical systems shown on the drawings and as specified herein.

B. Before covering or concealing any conduit below grade or slab, in wall or above ceiling, the contractor shall notify the Architect so that he can review the installation.

3.08 CONTRACTOR'S FINAL INSPECTION

A. Contractor shall refer to individual electrical specification sections for all testing, commissioning and training requirements specific to each section.

B. At the time of the Contractor's final inspection, all systems shall be checked and tested for proper installation and operation by the Contractor in the presence of the Architect or his representative.

C. The Contractor shall furnish the personnel, tools and equipment required to inspect and test all systems.

D. Following is a list of items that the contractor must demonstrate to the Architect or his representative as complying with the plans and specifications. Please note that this list does not necessarily represent all items to be covered in the final inspection, but should give the Contractor an idea of what is to be reviewed.

1. Service ground, show connection to ground rod and cold water main.
2. Demonstrate that main service equipment is properly bonded.
3. Demonstrate that all panels have breakers as specified, ground bar, copper bus, typed directory for circuit identification and that they are free of trash.
4. Demonstrate that all conduits are supported as required by the National Electrical Code.
5. Demonstrate that all conductors are providing with correct color coding. This should include all branch circuit neutral conductor striping.

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6. Demonstrate that all outlet boxes above or on the ceiling are supported as required by the National Electrical Code.
7. Demonstrate that outlet boxes in wall or ceilings of combustible materials are flush with surface of wall or ceiling, and that outlet boxes in walls or ceilings of non-combustible materials are so installed that the front edge of the box or plaster ring is not set back more than 1/4".
8. Demonstrate that outlet boxes in wall are secure.
9. Demonstrate that all devices are properly secured to boxes, that device plates are properly aligned and are not being used to secure device.
10. Utilizing a Woodhead No. 1750 testing device, demonstrate that all 125 volt receptacles are properly connected.
11. Demonstrate that all fixtures have specified lamps, ballast and lens, and that they are supported as required by the National Electrical Code or as called for on the drawings or in the specifications.
12. Demonstrate that all disconnects requiring fuses are fused with the proper size and type, and that all disconnects are properly identified.
13. Demonstrate that Fire Alarm System and Intrusion Alarm System are in proper working order, initiating an alarm signal from each manual and automatic device (including smoke detectors).
14. Demonstrate that Exterior Athletic Lighting is in proper working order and meeting all requirements outlined in specifications.
15. Demonstrate that CCTV System is in proper working order and meeting all requirements outlined in specifications.
16. Demonstrate that Performance Sound System is in proper working order and meeting all requirements outlined in specifications.

END OF SECTION

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SECTION 26 0005

ELECTRICAL SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes requirements for the preparation of Electrical Division 16 Shop Drawings, Product Data, Samples, and other submittals.

PART 2 - PRODUCTS

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

B. All submittals shall be submitted in electronic format.

C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into indexed files incorporating submittal requirements of each single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.

a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information for EACH SECTION:

a. Project name.

b. Date.

c. Name and address of Architect.

d. Name of Construction Manager/General Contractor.

e. Name of Electrical Contractor.

f. Name of firm or entity that prepared submittal.

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g. Names of subcontractor, manufacturer, and supplier.

h. Specification Section number and title.

i. Indication of full or partial submittal.

D. Options: Identify options requiring selection by Architect.

E. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

F. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

2.02 SUBMITTAL DATA – REFER TO EACH SPECIFICATION SECTION FOR REQUIREENTS

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

1. Mark each copy of each submittal to show which products and options are applicable.

2. 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.

3. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.

b. Printed performance curves.

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c. Operational range diagrams.

d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

4. Submit Product Data 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.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.

C. 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.

D. 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.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

A. 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. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

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3.02 ENGINEER'S ACTION

A. Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it.

B. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

C. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION

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SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.02 SUBMITTALS REQUIRED

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.
2. Cerro Wire LLC.
3. Encore Wire Corporation.
4. General Cable; General Cable Corporation.
5. Senator Wire & Cable Company.
6. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2 and Type SO.

2.02 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. AFC Cable Systems, Inc.
3. Gardner Bender.
4. Hubbell Power Systems, Inc.
5. Ideal Industries, Inc.
6. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.

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B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION, APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

a. Color shall be factory applied to outer jacket of conductor for all conductors of sizes No. 6 AWG and smaller.
b. Color shall be factory applied or field applied for sizes larger than No. 4 AWG, if authorities having jurisdiction permit.
c. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral: White
5) Multi-wire branch circuit Dedicated Neutral: White with appropriate tracer (white with red tracer, white with blue tracer, white with black tracer).

d. Colors for 480/277-V Circuits:

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1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral: Gray
5) Multi-wire branch circuit Dedicated Neutral: White with appropriate tracer (gray with brown tracer, gray with orange tracer, gray with yellow tracer)

e. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

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3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 7 "Penetration Firestopping."

3.08 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

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SECTION 26 0526

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes grounding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

1.02 SUBMITTALS REQUIRED

A. Product Data: For each type of product indicated.

1.03 CLOSEOUT DOCUMENTS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Harger Lightning and Grounding.
4. ILSCO.
5. O-Z/Gedney; A Brand of the EGS Electrical Group.

2.02 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

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B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches by 12 inches(unless otherwise noted on drawings) in cross section, with 9/32-inchholes spaced 1-1/8 inchesapart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.03 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.04 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

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D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 6 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.04 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

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3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3.05 LABELING

A. Comply with requirements in Section 26 0553 "Electrical Identification" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal , and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

C. Grounding system will be considered defective if it does not pass tests and inspections.

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D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power Distribution Units or Panelboards Serving Electronic Equipment: 25 ohm(s).

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

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SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.02 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.03 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.04 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.

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f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Painted Coatings: Manufacturer standard painted coating applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

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PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inchin diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To New Concrete: Bolt to concrete inserts.
2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
3. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 .
4. To Light Steel: Sheet metal screws.
5. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.

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B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 incheslarger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils

END OF SECTION

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SECTION 26 0533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.02 SUBMITTALS REQUIRED

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Tube & Conduit.
2. Electri-Flex Company.
3. O-Z/Gedney.
4. Republic Conduit.
5. Thomas & Betts Corporation.
6. Western Tube and Conduit Corporation.
7. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. FMC: Comply with UL 1; zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

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G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT, FMC and LFMC:

a. Material: Steel.
b. Type: Provide compression type for two inches (2") and smaller, steel set-screw type for conduits two and half inches (2 ½") and larger.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

H. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CANTEX Inc.
2. Condux International, Inc.
3. Electri-Flex Company.
4. Heritage Plastics
5. Kraloy.
6. Lamson & Sessions; Carlon Electrical Products.
7. RACO; Hubbell.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Mono-Systems, Inc.

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4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.04 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. EGS/Appleton Electric.
2. Erickson Electrical Equipment Company.
3. FSR Inc.
4. Hoffman.
5. Hubbell Incorporated.
6. Kraloy.
7. Milbank Manufacturing Co.
8. Mono-Systems, Inc.
9. O-Z/Gedney.
10. RACO; Hubbell.
11. Robroy Industries.
12. Thomas & Betts Corporation.
13. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Four gang: Wiremold RFB4 series floor box shall be manufactured from stamped steel and be approved for use on above grade floors. The box shall be 12 3/4" L x 10" W x 3 7/16" H. There shall be four independent wiring compartments that allow capacity for up to four duplex receptacles and/or communication services. The RFB4 Series Box shall permit tunneling from end power compartment to end power compartment. The RFB4-4DB Series Box shall permit tunneling from adjacent or opposite compartments. Two of the four compartments shall have a minimum wiring capacity of 16.4 cu in. one compartment shall have a minimum capacity of 32.3 cu in. , and one compartment shall have a minimum capacity of 50 cu in. . The box shall provide the following number of

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conduit knockouts: one 1/2", three 1" , six 3/4" , and six 1 1/4" . The box shall be fully adjustable, providing a maximum of 1 7/8" pre-pour adjustment, and a maximum of 3/4" after-pour adjustment. The box shall provide a series of device mounting plates that will accept both duplex power devices, as well as plates that will accommodate Ortronics workstation connectivity outlets and modular inserts, the Pass & Seymour Network Wiring System, and other open system devices.

2. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1. All boxes shall be labeled to identify circuits numbers and designations, or low-voltage systems use.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover. All boxes shall be labeled to identify circuit's numbers and designations, or low-voltage systems use.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

K. Cabinets:

1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.05 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. Quazite: Hubbell Power System, Inc.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC." or “Communications”.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes dimensions as noted on drainings: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC, EMT, RNC, Type EPC-40-PVC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Gymnasiums.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT, Type EPC-40-PVC to 48”AFF.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inchtrade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

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1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings. Steel compression type for two inches (2") and smaller, steel set-screw type for conduits two and half inches (2 ½") and larger Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicated on Drawings.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inchesaway from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inchtrade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footntervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inchof concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

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K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inchtrade size and insulated throat metal bushings on 1-1/2-inchtrade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inchtrade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lbtensile strength. Leave at least 12 inchesof slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inchesand with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 degF and that has straight-run length that exceeds 25 feet Install in each run of aboveground RMC and EMT conduit that is located where environmental

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temperature change may exceed 100 degFand that has straight-run length that exceeds 100 feet

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg Ftemperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg Ftemperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg Ftemperature change.
    d. Attics: 135 deg Ftemperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degFof temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per degFof temperature change for metal conduits.

W. Install expansion fittings at all locations where conduits cross building or structure expansion joints. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inchesof flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

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1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 3 "Earth Moving" for pipe less than 6 inchesin nominal diameter.
2. Install backfill as specified in Division 3 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inchesof finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 2000 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles, equipment, and at all building floor penetrations.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inchesof concrete for a minimum of 12 incheson each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inchesfrom edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
    c. All rigid steel conduit elbows shall be wrapped with Scotchwrap #50 corrosion protection tape.

5. Underground Warning Tape: Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inchsieve to No. 4sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

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3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.06 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.07 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

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SECTION 26 0544

SLEEVES FOR RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Grout.

B. Related Requirements:

1. Division 7 Section "Through-Penetration Firestop Systems" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.02 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

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PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

END OF SECTION

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SECTION 26 0553

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Equipment identification labels.

1.02 SUBMITTALS REQUIRED

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.03 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.04 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

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D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.02 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.03 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2.04 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a black background. Minimum letter height shall be 3/8 inch

2.05 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

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1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 9 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

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G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inchesbelow finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inchesoverall.

H. Painted Identification: Comply with requirements in Division 9 painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of all junction and pull boxes of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. Junction boxes containing line voltage wiring shall include panel and circuit designation (ex. HA - 1,3,5 or LA – 2,4,6).

B. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. Lighting
4. Fire Alarm System
5. Intrusion Alarm System

C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

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G. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inchigh letters for emergency instructions at equipment used for power transfer.

H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inchigh letters on 1-1/2-inchigh label; where two lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Switchboards.
    d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    e. Emergency system boxes and enclosures.
    f. Enclosed switches.
    g. Enclosed circuit breakers.
    h. Power transfer equipment.
    i. Power-generating units.
    j. Monitoring and control equipment.
    k. Junction boxes

END OF SECTION

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SECTION 26 0923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following lighting control devices:

1. Standalone daylight-harvesting switching controls.
2. Indoor occupancy sensors.
3. Switchbox-mounted occupancy sensors.
4. Digital timer light switches.
5. Emergency shunt relays.

1.02 SUBMITTALS REQUIRED

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

E. Sample Warranty: For manufacturer's warranties.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Products supplied shall be from a single manufacturer that has been continuously involved in manufacturing of occupancy sensors for a minimum of five years. Mixing of manufacturers shall not be allowed.

C. All components shall be U.L. listed, offer a five year warranty and meet all state and local applicable code requirements.

1.04 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

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1.05 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of lighting control software.
b. Faulty operation of lighting control devices.

2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Greengate
4. Watt Stopper.

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

a. Sensor: Suitable for mounting in any position on a standard outlet box.
b. Relay: Externally mounted through a 1/2-inchknockout in a standard electrical enclosure.
c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc keep lighting off when selected lighting level is present.
8. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
9. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

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10. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
11. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
12. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
13. All sensors shall have UL rated, 94V-0 plastic enclosures.

C. PIR Type: Wall/Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Basis-of-Design Product: Subject to compliance with requirements, provide the following or a comparable product from the listed manufactures:

    a. Watt Stopper: CX-100

2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
3. Detection Coverage (Rooms, High Ceilings): Detect occupancy anywhere in a circular area of 1000 sq. ft.when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Corridor, High Ceilings): Detect occupancy within 90 feetwhen mounted on a 10-foot-high ceiling.

D. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Basis-of-Design Product: Subject to compliance with requirements, provide the following or a comparable product from the listed manufactures:

    a. Watt Stopper: CI-200

2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
3. Detection Coverage (Room, High Ceilings): Detect occupancy anywhere in a circular area of 1000 sq. ft.when mounted on a 96-inch-high ceiling.

E. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

1. Basis-of-Design Product: Subject to compliance with requirements, provide the following or a comparable product from the listed manufactures:

    a. Watt Stopper: WT Series

2. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inchesin either a horizontal or a vertical manner at an approximate speed of 12 inches/s
3. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft.when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Standard Rooms, Restrooms): Detect occupancy anywhere within a circular area of 1000 sq. ft.when mounted on a 96-inch-high ceiling.
5. Detection Coverage (Large Room, Restrooms): Detect occupancy anywhere within a circular area of 2000 sq. ft.when mounted on a 96-inch-high ceiling.

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6. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feetwhen mounted on a 10-foot-high ceiling in a corridor not wider than 14 feet

F. Dual-Technology Type: Wall/Ceiling corner mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Basis-of-Design Product: Subject to compliance with requirements, provide the following or a comparable product from the listed manufactures:

a. Watt Stopper: DT-200

2. Sensitivity Adjustment: Separate for each sensing technology.
3. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s
4. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft.when mounted on a 96-inch-high ceiling.

G. Dual-Technology Type: Ceiling mounting 360 degree coverage; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Basis-of-Design Product: Subject to compliance with requirements, provide the following or a comparable product from the listed manufactures:

a. Watt Stopper: DT-300

2. Sensitivity Adjustment: Separate for each sensing technology.
3. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s
4. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.02 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Greengate
4. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft.
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: as shown on drawings
4. Voltage: Match the circuit voltage.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.03 DIGITAL TIMER LIGHT SWITCH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Greengate
4. Watt Stopper.

B. Description: Combination digital timer and conventional switch lighting control unit. Switchbox-mounted, backlit LCD display, with selectable time interval in 10 minute increments.

1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 amps at 277-V ac for ballast or LED, and 1/4 horsepower at 120-V ac.
2. Integral relay for connection to BAS.
3. Voltage: Match the circuit voltage.
4. Color: match wiring devices
5. Faceplate: Color matched to switch.

2.04 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lighting Control and Design, Inc.
2. Wattstopper.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. Coil Rating: as required.

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2.05 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Division 26 Section "Conductors and Cables."

PART 3 - EXECUTION

3.01 OCCUPANCY SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room at no additional cost.

C. It is the contractor’s responsibility to arrange a pre-installation meeting with manufacturer's factory authorized representative, at owner's facility, to verify placement of sensors and installation criteria.

D. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

3.02 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.03 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Conductors and Cables." Minimum conduit size shall be 1/2 inch.

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B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.04 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.05 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. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

C. Lighting control devices that fail tests and inspections are defective work.

3.06 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.

B. Upon completion of the system fine tuning the factory authorized technician shall provide the proper training to the owner's personnel in the adjustment, operation and maintenance of the sensors.

C. The electrical contractor shall provide the manufacturer, owner, architect and the electrical engineer with ten working days written notice of the scheduled commissioning date.

3.07 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

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1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.08 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Lighting Controls."

END OF SECTION

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SECTION 26 2200

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.02 SUBMITTALS REQUIRED

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.04 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.05 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

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PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Products.
2. General Electric Company.
3. Siemens Energy & Automation, Inc.
4. Square D; Schneider Electric.

2.02 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Aluminum.

2.03 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20 and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Interior Enclosures: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Exterior Enclosures: Ventilated, NEMA 250, Type 3R.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: Gray.

F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

H. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

I. Energy Efficiency for Transformers Rated 15 kVA and Larger:

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1. Complying with NEMA TP 1, Class 1 efficiency levels.
2. Tested according to NEMA TP 2.

J. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.

2.04 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Electrical Identification."

2.05 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Floor mounted transformers: Install transformers on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Division 3 Section.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For transformers, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor. Provide isolation pads (to mitigate vibration noise) between concrete pad and transformer base.

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3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts required for proper attachment to transformer.

3.03 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

3.05 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.06 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

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SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.02 SUBMITTALS REQUIRED

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1.03 CLOSEOUT DOCUMENTS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.06 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary

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HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 24 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    b. Outdoor Locations: NEMA 250, Type 3R.
    c. Kitchen and Wash-Down Areas: NEMA 250, Type 4X,.
    d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Height: 84 inches maximum.
3. Door-in-Door Front Cover: Provide true door in door panel front construction, not piano hinged cover. Trims shall cover all live parts and shall have no exposed hardware. “EZTrim” is <u>not</u> acceptable.
4. Finishes:

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a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

F. Incoming Mains:

1. Location: Top and/or bottom, as required for configurations shown on drawings.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

a. Plating shall run entire length of bus.
b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
5. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

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1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical, unless otherwise noted.

2.02 PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs only, as indicated on drawings.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

G. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

H. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.03 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.

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b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

   a. RMS sensing.
   b. Field-replaceable rating plug or electronic trip.
   c. Digital display of settings, trip targets, and indicated metering displays.
   d. Multi-button keypad to access programmable functions and monitored data.
   e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
   f. Integral test jack for connection to portable test set or laptop computer.
   g. Field-Adjustable Settings:

      1) Instantaneous trip.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Subfeed Circuit Breakers: Vertically mounted.
8. MCCB Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.
   b. Breaker handle indicates tripped status.
   c. UL listed for reverse connection without restrictive line or load ratings..
   d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
   f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
   h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
   i. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
   j. Multipole units enclosed in a single housing with a single handle.
   k. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
   l. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. BREAKER APPLICATION

1. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

   a. 400A frames and below: Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.

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b. 450 A frames and larger: Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

2.04 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Equipment Mounting:

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1. Install panelboards on cast-in-place concrete equipment base(s), 4-inchnominal thickness. Comply with requirements for concrete base specified in Division 3 Section.
2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.

J. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.

K. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

M. Install filler plates in unused spaces.

N. Stub four 1-inch empty conduits from all flush mounted panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

O. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 0553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

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D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 26 0553 "Identification for Electrical Systems" identifying source of remote circuit.

3.04 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Do not perform optional tests. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test continuity of each circuit.

B. Panelboards will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 0573 "Overcurrent Protective Device Coordination Study."

3.06 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

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SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Toggle switches and wall-box dimmers.
4. Pendant cord-connector devices.
5. Cord and plug sets.
6. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

B. Related Sections include the following:

1. Division 27 Section "Data Voice Cabling" for workstation outlets.

1.02 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

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1.05 CLOSEOUT DOCUMENTS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.02 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.03 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, Specification Grade, Tamper Resistant, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

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1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper: TR5362
    b. Hubbell: 5352TR
    c. Leviton: 5352TR
    d. Pass & Seymour: 5362TR

2.04 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type, tamper resistant.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, Specification Grade, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Cooper: VGF20TR
    b. Hubbell: GFTR20
    c. Leviton: M7899TR
    d. Pass & Seymour: 2095TR

2.05 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; CWL520R.
    b. Hubbell; HBL2310.
    c. Leviton; 2310.
    d. Pass & Seymour; L520-R.

2.06 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

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2.07 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.08 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

1) Single Pole:
   a) Cooper: CSB120
   b) Hubbell: CSB120
   c) Leviton: CSB1-20
   d) Pass & Seymour: CSB20AC1.

2) Two Pole:
   a) Cooper: CSB220
   b) Hubbell: CSB220
   c) Leviton: CSB2-20
   d) Pass & Seymour; CSB20AC2.

3) Three Way:
   a) Cooper: CSB320
   b) Hubbell: CSB320
   c) Leviton: CSB3-20
   d) Pass & Seymour; CSB20AC3.

4) Four Way:
   a) Cooper: CSB420
   b) Hubbell: CSB420
   c) Leviton: CSB4-20
   d) Pass & Seymour; CSB20AC4.

C. Pilot Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221PL for 120 and 277 V.
b. Hubbell; HBL1201PL for 120 and 277 V.
c. Leviton: 1221-PLR.
d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is

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"ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.
b. Hubbell; HBL1557.
c. Leviton; 1257.
d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995L.
b. Hubbell; HBL1557L.
c. Leviton; 1257L.
d. Pass & Seymour; 1251L.

2.09 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. LED Dimmer Switches: Modular; compatible with LED driver; trim potentiometer to adjust low-end dimming; dimmer-driver combination capable of consistent dimming with low end not greater than 10 percent of full brightness.

2.10 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035 inch-thick, over-sized “jumbo” satin finished stainless steel.

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3. Material for Unfinished Spaces: 0.035 inch-thick, over-sized “jumbo” satin finished stainless steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.11 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, die-cast aluminum with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable.

2.12 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70 or device listing. Provide brown devices shown on stained wood surfaces. Coordinate with Architectural surface finish infrastructure.
2. Wiring Devices Connected to Emergency Power System: Red

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

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C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. Use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Use oversized or jumbo plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

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I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 IDENTIFICATION

A. Comply with Division 26 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

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SECTION 26 2813

FUSES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, enclosed controllers and motor-control centers.
2. Spare-fuse cabinets.

1.02 SUBMITTALS REQUIRED

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Current-limitation curves for fuses with current-limiting characteristics.

1.03 CLOSEOUT

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Coordination charts and tables and related data.

1.04 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

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B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

1.06 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.02 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.03 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

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B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK1, time delay.
2. Other Branch Circuits: Class RK1, time delay.
3. Control Circuits: Class CC, time delay.

3.03 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

3.04 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Electrical Identification" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

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SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Molded-case circuit breakers (MCCBs).
3. Enclosures.

1.02 SUBMITTALS REQUIRED

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.

D. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg Fand not exceeding 104 deg F
2. Altitude: Not exceeding 6600 feet

1.05 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.02 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

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1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

2.03 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X , stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4 .
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

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B. Install fuses in fusible devices.

C. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Electrical Identification."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test continuity of each circuit.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

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SECTION 26 4313

SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.02 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.03 SUBMITTALS REQUIRED

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.04 CLOSEOUT DOCUMENTS

A. Maintenance Data: For SPDs to include in maintenance manuals.

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1.05 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.02 SERVICE ENTRANCE SUPPRESSOR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation.
2. Emerson Electric Co.
3. GE Zenith Controls.
4. PowerLogics, Inc.
5. Schneider Electric Industries SAS.
6. Siemens Industry, Inc.
7. Current Technologies

B. SPDs: Comply with UL 1449, Type 2.

1. SPDs with the following features and accessories:

a. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
b. Indicator light display for protection status.
c. Form-C contacts rated at 2 A and 24-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
d. Surge counter.

C. Comply with UL 1283.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 300 Ka per mode/600 Ka per phase. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

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E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 800 V for 480Y/277 V.
2. Line to Ground: 800 V for 480Y/277 V.
3. Line to Line: 1350V for 480Y/277 V.

F. SCCR: Equal or exceed 300 kA.

2.03 PANEL SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation.
2. Emerson Electric Co.
3. GE Zenith Controls.
4. LEA International; Protection Technology Group.
5. Schneider Electric Industries SAS.
6. Siemens Industry, Inc.
7. Current Technologies

B. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 80 kA per mode 80/19 Ka 0 per phase. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Comply with UL 1283.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 400 V for 480Y/277 V 700 V for 208Y/120 V.
2. Line to Ground: 400 V for 480Y/277 V 700 V for 208Y/120 V.
3. Neutral to Ground: 400 V for 480Y/277 V 700 V for 208Y/120 V.

F. SCCR: Equal or exceed 80 kA.

2.04 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

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2.05 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

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3.03 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION

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SECTION 26 5116

INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior luminaires, LED module, and drivers.
2. Luminaire supports.

1.02 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. IP: International Protection or Ingress Protection Rating

D. Lumen: Measured output of lamp and luminaire, or both.

E. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.03 SUBMITTALS REQUIRED

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project.

B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

C. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

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1.05 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory is accredited under the NVLAP for Energy Efficient Lighting Products.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.07 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
   1. LED Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598.

D. Nominal Operating Voltage: see drawings.

E. Recessed Luminaires: Comply with NEMA LE 4.

2.02 LED LUMINARIES

A. CRI of minimum 80.

B. Rated lamp life of 50,000 hours.

C. Lamps dimmable from 100 percent to 10 percent of maximum light output, unless otherwise noted.

D. Internal driver. Provide with standard 0-10V dimming.

2.03 MATERIALS

A. Metal Parts:

   1. Free of burrs and sharp corners and edges.
   2. Sheet metal components shall be steel unless otherwise indicated.

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3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

C. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.04 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.05 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish shall match luminaire.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.03 INSTALLATION

A. Comply with NECA 1.

B. Remote Mounting of Drivers: Distance between the driver and luminaire shall not exceed that recommended by driver manufacturer. Verify, with driver manufacturers, maximum distance between driver and luminaire.

C. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

D. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them.

E. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

F. Ceiling-Grid-Mounted Luminaire Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inches from luminaire corners. Provide a minimum of two wires on opposite corners of fixture
2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

G. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

H. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

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2. Do not attach luminaires directly to gypsum board.

I. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing, rod or wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

J. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 0533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

B. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to emergency power and retransfer to normal.

C. Luminaire will be considered defective if it does not pass operation tests and inspections.

D. Prepare test and inspection reports.

3.06 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

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SECTION 26 56 68

EXTERIOR ATHLETIC LIGHTING

Lighting System with LED Light Source

PART 1 – GENERAL

1.1 SUMMARY

A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.

B. The purpose of these specifications is to define the lighting system performance and design standards for Worth County High School Track using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.

C. The sports lighting will be for the following venues:

1. Field
2. Bleachers
3. Track
4. Shot Put
5. Discus
6. High Jump
7. Long Jump
8. Triple Jump
9. Pole Vault

D. The primary goals of this sports lighting project are:

1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore, light levels are guaranteed to not drop below specified target values for a period of 25 years.
2. Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators, and neighbors.
3. Cost of Ownership: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated for the duration of the warranty.
4. Control and Monitoring: To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system. Fields should be proactively monitored to detect luminaire outages over a 25-year life cycle. All network, communication, and monitoring costs for 25-year period shall be included in the bid.

1.2 LIGHTING PERFORMANCE

A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed, and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not to drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

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Area of Lighting	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Field	30 FC	2:1	30' x 30'	72
Bleachers	22 FC	2.5:1	10' x 10'	18
Track	30 FC	3:1	30' x 30'	46
Shot Put	40 FC	1.5:1	10' x 10'	37
Discus	40 FC	1:5:1	10' x 10'	265
High Jump	35 FC	1.5:1	10' x 10'	38
Long Jump	30 FC	2.5:1	20' x 20'	20
Triple Jump	30 FC	3:1	10' x 10'	20
Pole Vault	25 FC	3.5:1	5' x 5'	52

B. Color: The lighting system shall have a minimum color temperature of 5700K and a CRI of 75.

C. DLC Approval & Minimum Fixture Efficacy: Fixture must be DLC-approved and the meet minimum requirement of 105 lumens per watt.

D. Mounting Heights: To ensure proper aiming angles for reduced glare and to ensure optimal playability, minimum mounting heights shall be as described below. Higher mounting heights may be required, based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal. Refer to Section 1.3B for additional requirements.

# of Poles	Pole Designation	Minimum Pole Height
4	F1-F4	70'

1.3 ENVIRONMENTAL LIGHT CONTROL

A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers and external shields. No symmetrical beam patterns are accepted.

B. Engineered Spill Light and Glare Control Calculations: To minimize impact on adjacent properties, spill light and candela values must not exceed levels shown in the below chart --- calculated at 3 feet above grade at the 150' radius line surrounding the field as specified on the drawings.

C. Engineered lighting scans must be submitted indicating the amount of horizontal and vertical footcandles, and candela along the specified lines. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights. Illumination level shall be measured in accordance with the IESNA LM-5-04 after 1 hour warm up.

Calculations must be shown along the 150' radius line from the edge of the field as shown on the drawings, and must not exceed the following:

	Average	Maximum
Horizontal Footcandles	.005 fc	.1 fc
Vertical Footcandles	.02 fc	.2 fc
Candela (Glare)	2000 cd	7500 cd

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If a manufacturer's engineered lighting scan indicates that the above criteria cannot be met, then an increase in pole mounting heights would be acceptable provided that these specified values are achieved.

C. Glare Control & Photometric Reports: Light Fixture Upper Beam Candlepower Requirements

To ensure optimal glare control, light fixtures' candlepower at 15 degrees above the center of its beam shall not exceed the candlepower specified below:

NEMA Classification of Vertical Beam	Maximum Allowable Candela	Degrees Above the Center of the Beam in the Vertical Plane
3, 4 and 5	7,500 cd	15 degrees

For all luminaire types being proposed on this project, the first page of a photometric report showing horizontal and vertical axial candle power shall be provided in order to demonstrate the capability of achieving this specified performance. Reports shall be certified by a qualified testing laboratory with a minimum of five years' experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report. Photometric reports must reflect wattages only for actual fixture(s) being proposed for this project.

1.4 Cost of Ownership

A. Manufacturer shall submit a 25 year Cost of Ownership summary that includes energy consumption, anticipated maintenance costs, and control costs. All costs associated with faulty luminaire replacement - equipment rentals, removal and installation labor, and shipping - are to be included in the maintenance costs.

B. Guaranteed Energy Consumption: In order to ensure optimal energy efficiency, the total system's specified kW consumption shall not exceed 60 kW/h.

PART 2 – PRODUCT

2.2 SPORTS LIGHTING SYSTEM CONSTRUCTION

A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested.

B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.

C. System Description: Lighting system shall consist of the following:

1. Galvanized steel poles and cross-arm assembly.

2. Non-approved pole technology:

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a. Square static cast concrete poles will not be accepted.

b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long term performance concerns.

3. Lighting systems shall use concrete foundations. See Section 2.4 for details.

   a. For a foundation using a pre-stressed concrete base embedded in concrete backfill the concrete shall be air-entrained and have a minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole erection; actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.

   b. For anchor bolt foundations, or foundations using a pre-stressed concrete base in a suspended pier or reinforced pier design, pole erection may occur after 7 days. Or after a concrete sample from the same batch achieves a certain strength.

4. Manufacturer will supply all drivers and supporting electrical equipment

   a. Remote drivers and supporting electrical equipment shall be pole-mounted approximately 10 feet above grade in aluminum enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure.

      If active cooling fans are utilized in the remote driver enclosure, then these are required to be wired for the control system to self-monitor and automatically report any failure or issue to the manufacturer and/or owner. Technical cutsheets (not illustrative) detailing this function would be a required inclusion in the mandatory pre-bid submittal detailed in Section 4.

   b. Integral drivers are not allowed.

   c. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2_2002. Technical cutsheets (not illustrative) detailing surge protection capabilities are required to be included in the mandatory submittal package detailed in Section 4

4. Wire harness complete with an abrasion protection sleeve, strain relief, and plug-in connections for fast, trouble-free installation.

5. All luminaires, visors, and cross-arm assemblies shall withstand 150 mi/h winds and maintain luminaire aiming alignment. Technical datasheets confirming this are required to be included in the mandatory submittal package detailed in Section 4.

6. Control cabinet to provide remote on-off control and active performance monitoring of the lighting system. See Section 2.3 for further details.

8. Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.

   a. Integrated grounding via concrete encased electrode grounding system.

   b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780.The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

D. Safety: All system components shall be UL listed for the appropriate application.

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2.2 ELECTRICAL

A. Electric Power Requirements for the Sports Lighting Equipment:
   1. Electric power: 480 Volt, 3 Phase
   2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.

B. Energy Consumption: The maximum total kW consumption for the lighting system shall be 60kW/h.

2.3 CONTROL

A. References: Manufacturer to provide a list of 10 projects where the below-specified control & monitoring system proposed for this project has been installed in the state of Georgia. Reference list will include project name, project city, and installation month & year. Project contact name and contact phone number must be included.

B. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.

C. Lighting contactor cabinet(s) with electrically-held contactors, constructed of NEMA Type 4 aluminum and designed for easy installation with contactors labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.

D. Dimming: System shall provide for 3-stage dimming (high-medium-low). Dimming will be set via scheduling options (Website, app, phone, fax, email).

E. Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.

   The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute “early off” commands by phone. Scheduling tool shall be capable of setting curfew limits.

   Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.

F. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).

G. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices.

   Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.

   1. Cumulative hours: shall be tracked to show the total hours used by the facility
   2. Report hours saved by using early off and push buttons by users.

H. Communication Costs: Manufacturer shall include communication costs for operating the control and monitoring system for a period of 25 years.

I. Communication with luminaire drivers: Control system shall interface with drivers in pole-mounted enclosures by means of powerline communication through the underground conductors feeding each pole.

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Control systems utilizing a wireless line-of-sight communication pathway to the luminaire drivers where power is fed directly from circuit breaker to light pole, and in which power distribution to the pole is constant regardless of on/off luminaire status -- are not acceptable due to long-term performance reliability risks.

2.4 STRUCTURAL PARAMETERS

A. Engineered Foundation Drawings: Project-specific foundation drawings --- stamped by a registered professional engineer in the state of Georgia --- are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole. These drawings must be included in the mandatory pre-bid submittal detailed in Section 4.1B.

B. Wind Loads: Wind loads shall be based on the 2018 International Building Code. Wind loads to be calculated using ASCE 7-16, an ultimate design wind speed of 115 and exposure category C.

C. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to 2013 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-6).

D. Soil Condition for Parameters Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report. If no geotechnical report is available, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by 2018 IBC Table 1806.2.

PART 3 – EXECUTION

3.1 SOIL QUALITY CONTROL

A. It shall be the Contractor's responsibility to notify the Owner if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated. Contractor may issue a change order request / estimate for the Owner's approval / payment for additional costs associated with:

1. Providing engineered foundation embedment design by a registered engineer in the State of Georgia for soils other than specified soil conditions;
2. Additional materials required to achieve alternate foundation;
3. Excavation and removal of materials other than normal soils, such as rock, caliche, etc.

3.2 DELIVERY TIMING

A. Delivery Timing Equipment On-Site: The equipment must be on-site 6-8 weeks from receipt of approved submittals and receipt of complete order information.

3.3 FIELD QUALITY CONTROL

A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.

B. Field Light Level Accountability

1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 years. These levels will be specifically stated as "guaranteed" on the illumination summary provided by the manufacturer.
2. The contractor/manufacturer shall be responsible for conducting initial light level testing and an

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additional inspection of the system, in the presence of the owner, one year from the date of commissioning of the lighting.

3. The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.

C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be required to make adjustments to meet specifications and satisfy Owner.

3.4 WARRANTY AND GUARANTEE

A. 25-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.

B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Manufacturer is responsible for removal and replacement of failed luminaires, including all parts, labor, shipping, and equipment rental associated with maintenance. Owner agrees to check fuses in the event of a luminaire outage.

PART 4 – DESIGN APPROVAL

4.0 PRE-BID SUBMITTAL PROCESS REQUIREMENTS

A. Design Approval: The consultant team will review mandatory pre-bid submittals 10 days prior to bid from all manufacturers to ensure compliance to the specification. If the submission meets these design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.

B. Approved Product: Musco is the approved basis of design and specification. All substitutions requests must provide a complete & engineered submittal package for approval as outlined in Section 4.1 at least 10 days prior to bid. An addendum will be issued prior to bid listing any other approved lighting manufacturers and/or designs. .

C. Special manufacturing to meet the standards of this specification may be required. Bidders are required to bid only products that have been approved by this specification or addendum by the consultant team. Bids received that do not utilize an approved system/design will be rejected.

4.2 MINIMUM DESIGN CRITERIA

A. Included in this specification section are design criteria, photometrics, energy consumption, and control criteria. The information contained here-in is the minimum design criteria and shall be met in all respects by product manufacturer.

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4.1 PRE-BID SUBMITTAL CONTENT REQUIREMENTS

REQUIRED SUBMITTAL INFORMATION FOR ALL MANUFACTURERS 10 DAYS PRIOR TO BID

All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements. Complete the Yes/No column to indicate compliance (Y) or noncompliance (N) for each item. Submit checklist below with submittal.

Yes / No	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	Equipment Layout	Drawing(s) showing field layouts with pole locations
	C	On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by b. Total kW consumption of the proposed lighting system c. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), Illuminance levels at grid spacing specified d. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens and optics e. Height of light test meter above field surface. f. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), coefficient of utilization (CU) uniformity gradient; number of luminaries, total kilowatts, average tilt factor; light loss factor.
	D	Off Field Lighting Design	Engineered lighting design drawings showing all specified calculations as detailed in Section 1.3
	E	Photometric Report	As fully detailed in Section 1.3C. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years' experience.
	F	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed to not fall below target levels for warranty period.
	G	Structural Engineering	Professionally-engineered foundation drawing as detailed in Section 2.4. Must be stamped by a structural engineer in the state of Georgia.
	H	Control & Monitoring System	Manufacturer of the control and monitoring system shall provide written definition and technical (not illustrative) schematics for automated control system. Also provide ten (10) references of facilities currently using the proposed system in the state of Georgia. Include facility contact names and telephone numbers.
	I	Electrical Distribution Plans	Manufacturer bidding an alternate product must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of Georgia.
	J	Warranty & References	Provide written warranty information, including all terms and conditions. Also provide ten (10) references of facilities in the state of Georgia currently under the proposed warranty. Facility contact names and telephone numbers to be provided.

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	K	References: Fixture Installations	Provide a list of ten (10) projects where the specific fixture proposed for this project has been installed in the state of Georgia. Facility contact names and telephone numbers to be provided.
	L	Product Information	Refer to Section 2 in its entirety for full requirements. Provide complete bill of material accompanied by current brochures/cut sheets for all products being provided. Cut sheets shall be technical (not illustrative) and provide specific detail on light fixtures, remote driver cabinets, drivers, surge protections, fusing, controls, poles and foundations. All certifications, including UL and DLC, shall be shown on the technical cut sheets.
	M	Delivery	Manufacturer shall supply an expected delivery timeframe from receipt of approved submittals and complete order information.
	O	Cost of Ownership	Document cost of ownership as defined in section 1.4. Identify energy costs for operating the luminaires. Maintenance cost for the system must be included. All costs should be based on 25 Years of operation

The information supplied herein shall be used for the purpose of complying with the specifications for Worth County High School Track using an LED Lighting source. By signing below, I agree that all requirements of the specifications have been met and that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in the Non-Compliance section.

Manufacturer: _____

Signature: _____ _____

Contact Name: _____

Date: _____/_____/_____

Contractor: _____

Signature: _____

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Worth County HS

Sylvester, GA

Lighting System

Pole / Fixture Summary

Pole ID	Pole Height	Mtg Height	Fixture Qty	Luminaire Type	Load	Circuit
F1	70'	70'	12	TLC-LED-1500	17.16 kW	A
F2	70'	70'	9	TLC-LED-1500	12.87 kW	A
F3	70'	70'	9	TLC-LED-1500	12.87 kW	A
		60'	1	TLC-LED-600	0.58 kW	A
F4	70'	70'	10	TLC-LED-1500	14.30 kW	A
		60'	1	TLC-LED-600	0.58 kW	A
4			***42***		***58.36 kW***	

Circuit Summary

Circuit	Description	Load	Fixture Qty
A	Football	58.36 kW	42

Fixture Type Summary

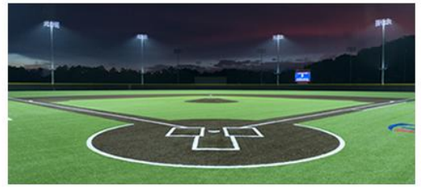
Type	Source	Wattage	Lumens	L90	L80	L70	Quantity
TLC-LED-1500	LED 5700K - 75 CRI	1430W	160,000	>120,000	>120,000	>120,000	40
TLC-LED-600	LED 5700K - 75 CRI	580W	65,600	>120,000	>120,000	>120,000	2

Light Level Summary

Calculation Grid Summary

Grid Name	Calculation Metric	Illumination					Circuits	Fixture Qty
		Ave	Min	Max	Max/Min	Ave/Min		
Bleachers	Horizontal Illuminance	21.9	13.7	32	2.34	1.60	A	42
Discus	Horizontal Illuminance	36.4	30.3	43.2	1.43	1.20	A	42
Football	Horizontal Illuminance	36.3	30.5	41.6	1.37	1.19	A	42
High Jump	Horizontal Illuminance	35	30.8	42	1.36	1.14	A	42
Long Jump	Horizontal Illuminance	25.2	16.2	35.1	2.17	1.55	A	42
Pole Vault	Horizontal Illuminance	20	10	30.4	3.05	2.00	A	42
Shot Put	Horizontal Illuminance	38.8	33	46.3	1.40	1.17	A	42
Stadium Spill/Glare - 200'	Horizontal Illuminance	0	0	0.05	0.00		A	42
Stadium Spill/Glare - 200'	Max Candela Metric	1146	20.5	6614	323.11	55.97	A	42
Stadium Spill/Glare - 200'	Max Vertical Illuminance Metric	0.02	0	0.16	614.83		A	42
Track	Horizontal Illuminance	30.7	18.7	47.7	2.55	1.64	A	42
Triple Jump	Horizontal Illuminance	29.8	14.8	39.6	2.68	2.01	A	42

From Hometown to Professional



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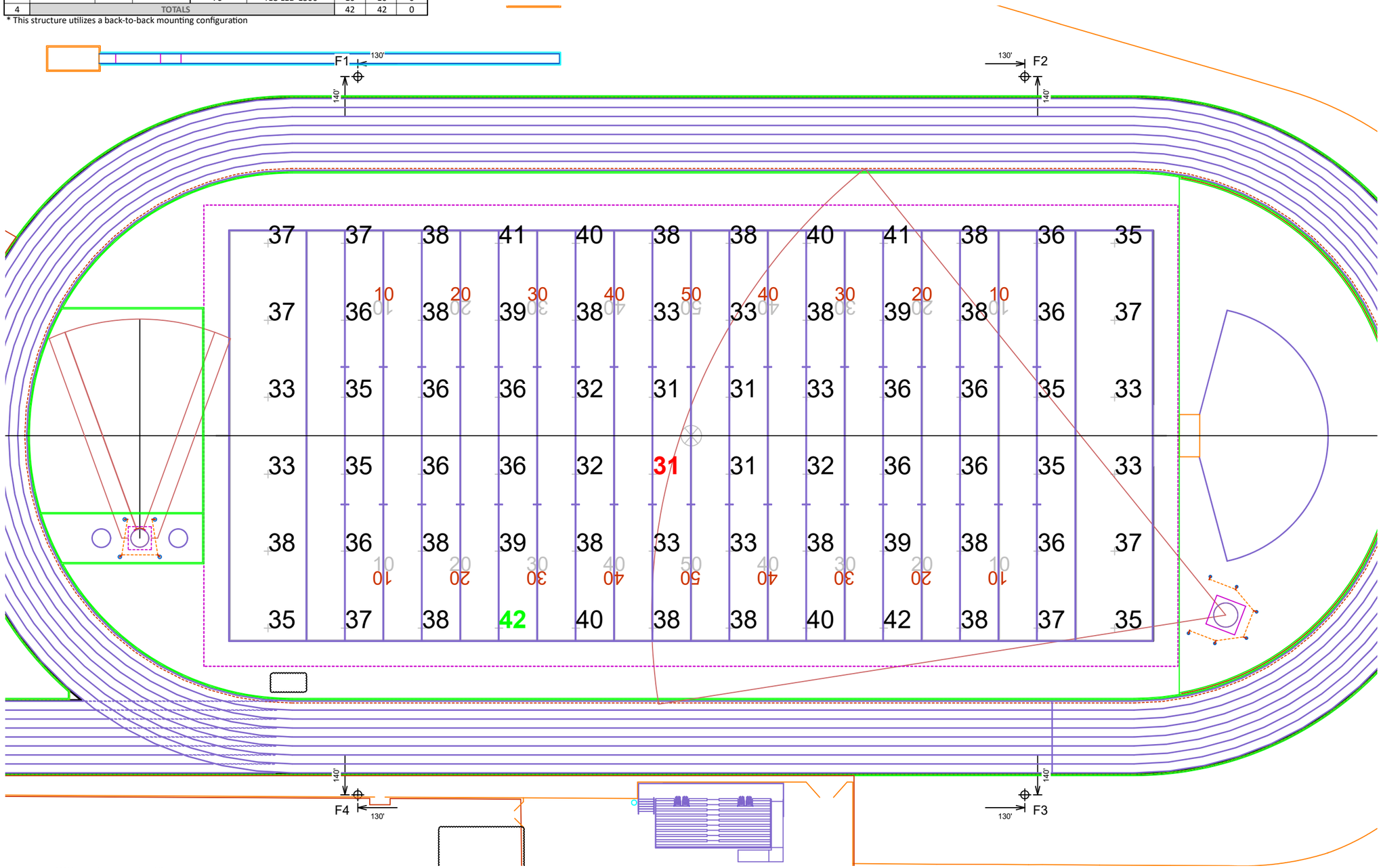
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

* This structure utilizes a back-to-back mounting configuration



Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: JWinegar • File #205129D • 08-Apr-20

Worth County HS

Sylvester, GA

GRID SUMMARY

Name:	**Football**
Size:	360' x 160'
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Guaranteed Average:	**30**
Scan Average:	36.30
Maximum:	41.6
Minimum:	30.5
Avg / Min:	1.19
Guaranteed Max / Min:	**2**
Max / Min:	1.37
UG (adjacent pts):	1.17
CU:	0.37
No. of Points:	72

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	160,000 / 52,000 / 65,600 lumens
No. of Luminaires:	**42**
Total Load:	58.36 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1500	>120,000	>120,000	>120,000
TLC-BT-575	>120,000	>120,000	>120,000
TLC-LED-600	>120,000	>120,000	>120,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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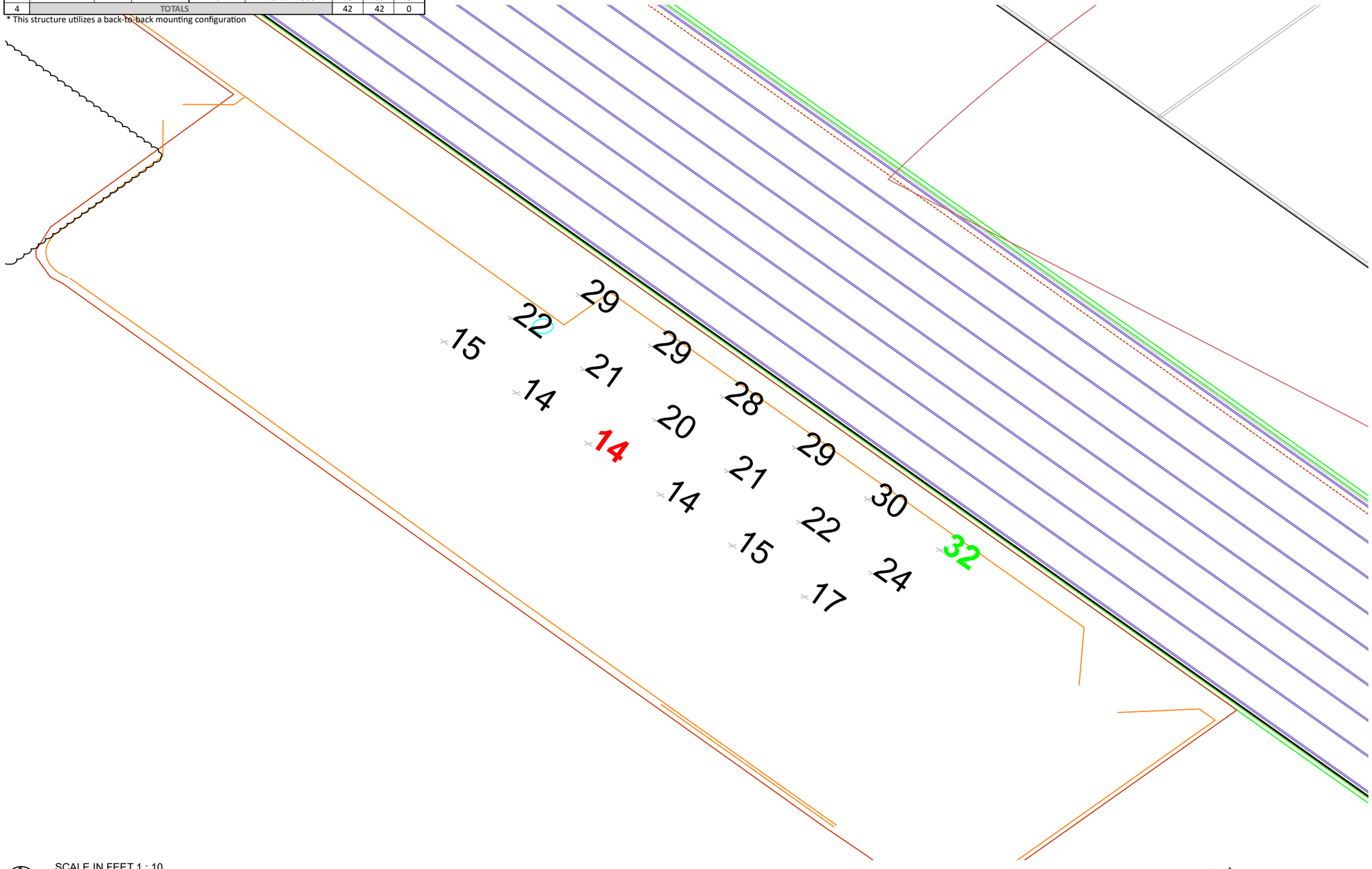
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

* This structure utilizes a back-to-back mounting configuration



SCALE IN FEET 1 : 10

0' 20' 40'

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Worth County HS

Sylvester, GA

GRID SUMMARY

Name:	**Bleachers**
Size:	360' x 160'
Spacing:	10.0' x 10.0'

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**21.87**
Maximum:	32.0
Minimum:	13.7
Avg / Min:	1.60
Max / Min:	**2.34**
UG (adjacent pts):	1.49
No. of Points:	18

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	160,000 / 52,000 / 65,600 lumens
No. of Luminaires:	**42**
Total Load:	58.36 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1500	>120,000	>120,000	>120,000
TLC-BT-575	>120,000	>120,000	>120,000
TLC-LED-600	>120,000	>120,000	>120,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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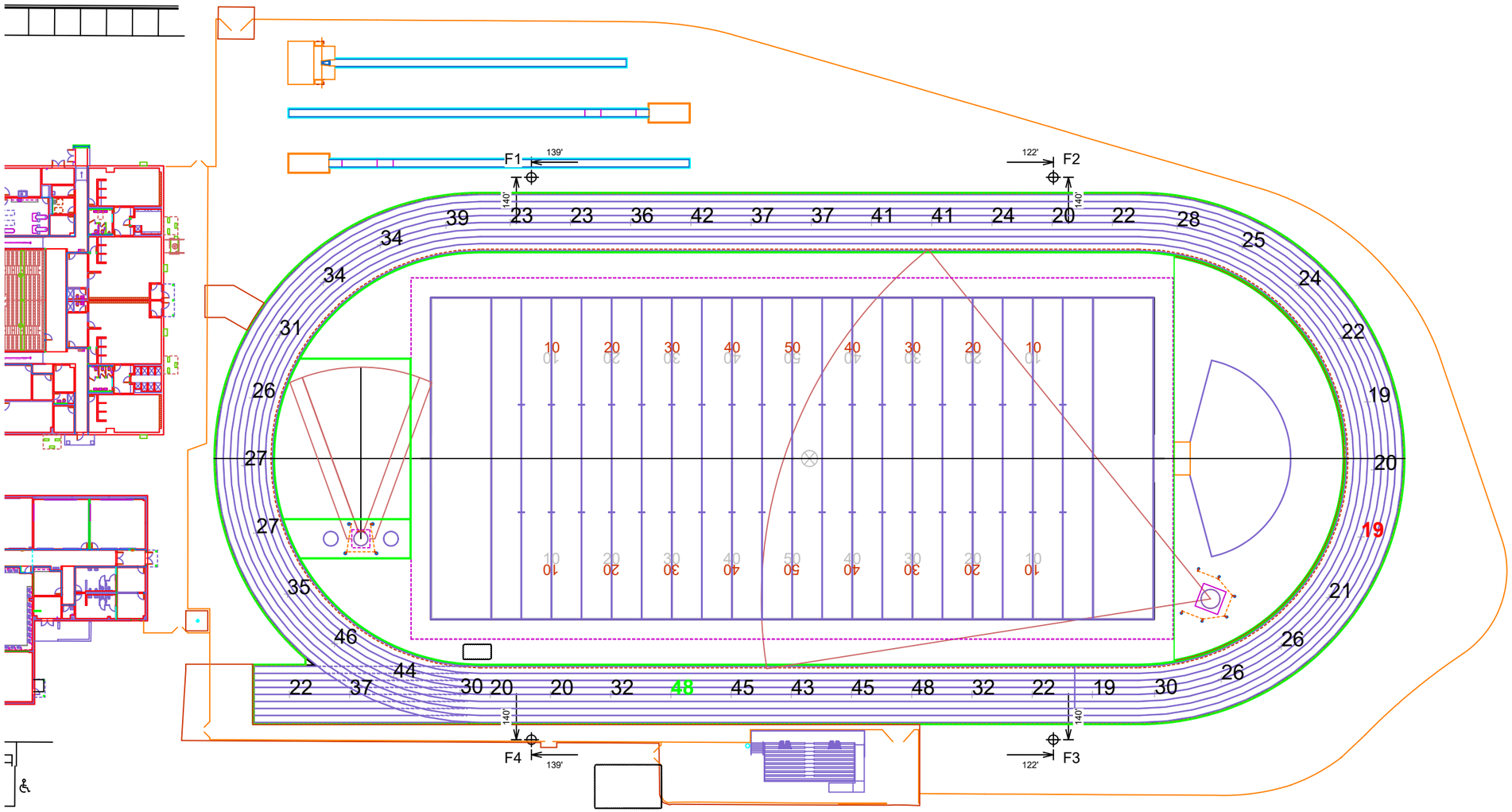
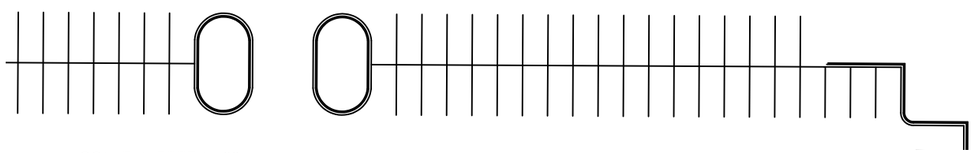
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

* This structure utilizes a back-to-back mounting configuration





SCALE IN FEET 1 : 60

0' 60' 120'

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Worth County HS

Sylvester, GA

GRID SUMMARY

Name:	**Track**
Size:	Irregular
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Guaranteed Average:	**30**
Scan Average:	30.67
Maximum:	47.7
Minimum:	18.7
Avg / Min:	1.64
Guaranteed Max / Min:	**3**
Max / Min:	2.55
UG (adjacent pts):	0.00
CU:	0.20
No. of Points:	46

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	160,000 / 52,000 / 65,600 lumens
No. of Luminaires:	**42**
Total Load:	58.36 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1500	>120,000	>120,000	>120,000
TLC-BT-575	>120,000	>120,000	>120,000
TLC-LED-600	>120,000	>120,000	>120,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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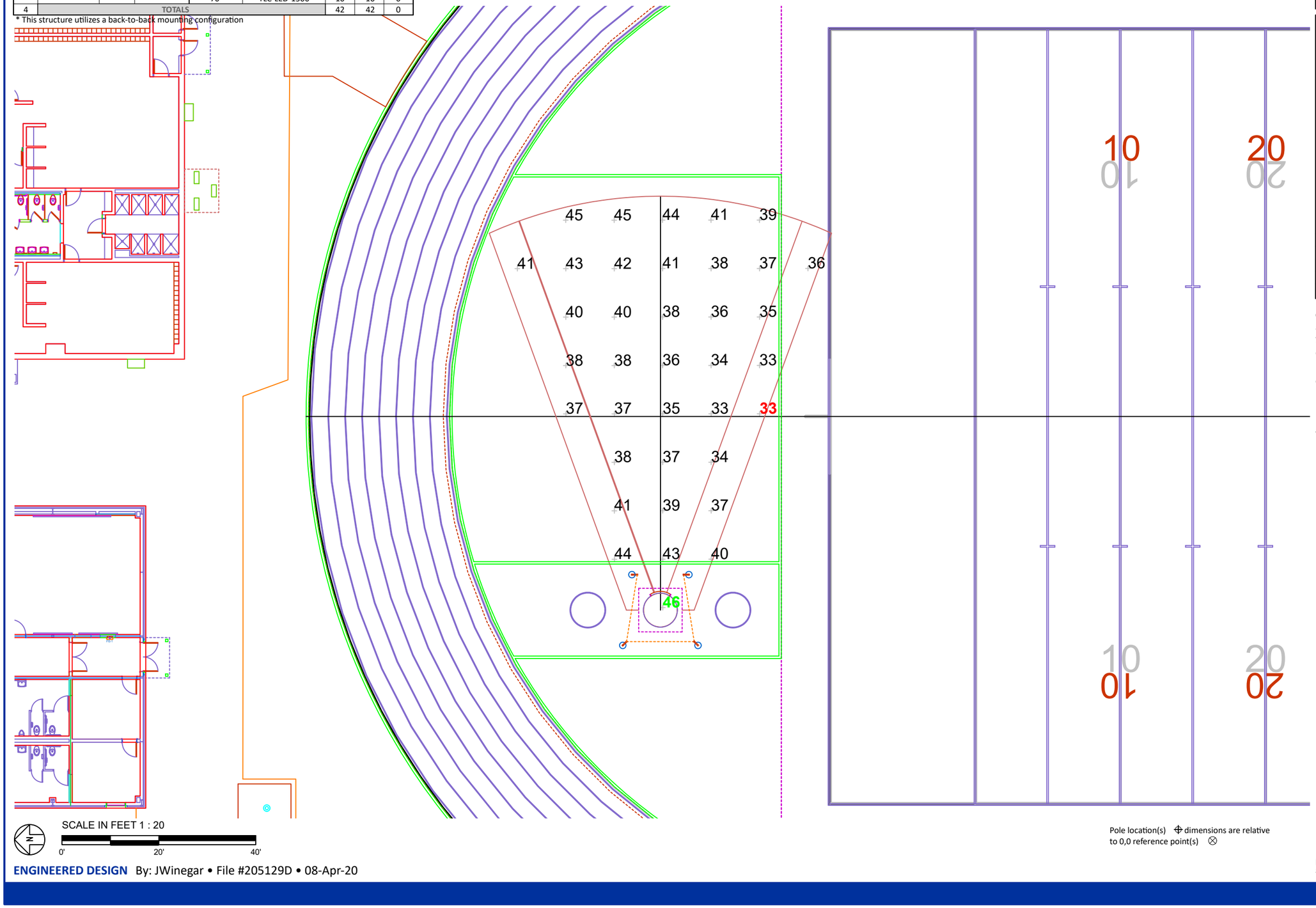
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

* This structure utilizes a back-to-back mounting configuration



Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

Worth County HS

Sylvester, GA

GRID SUMMARY

Name:	**Shot Put**
Size:	Irregular
Spacing:	10.0' x 10.0'
Height:	0.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**38.76**
Maximum:	46.3
Minimum:	33.0
Avg / Min:	1.18
Max / Min:	**1.40**
UG (adjacent pts):	1.09
CU:	0.02
No. of Points:	37

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	160,000 / 52,000 / 65,600 lumens
No. of Luminaires:	**42**
Total Load:	58.36 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1500	>120,000	>120,000	>120,000
TLC-BT-575	>120,000	>120,000	>120,000
TLC-LED-600	>120,000	>120,000	>120,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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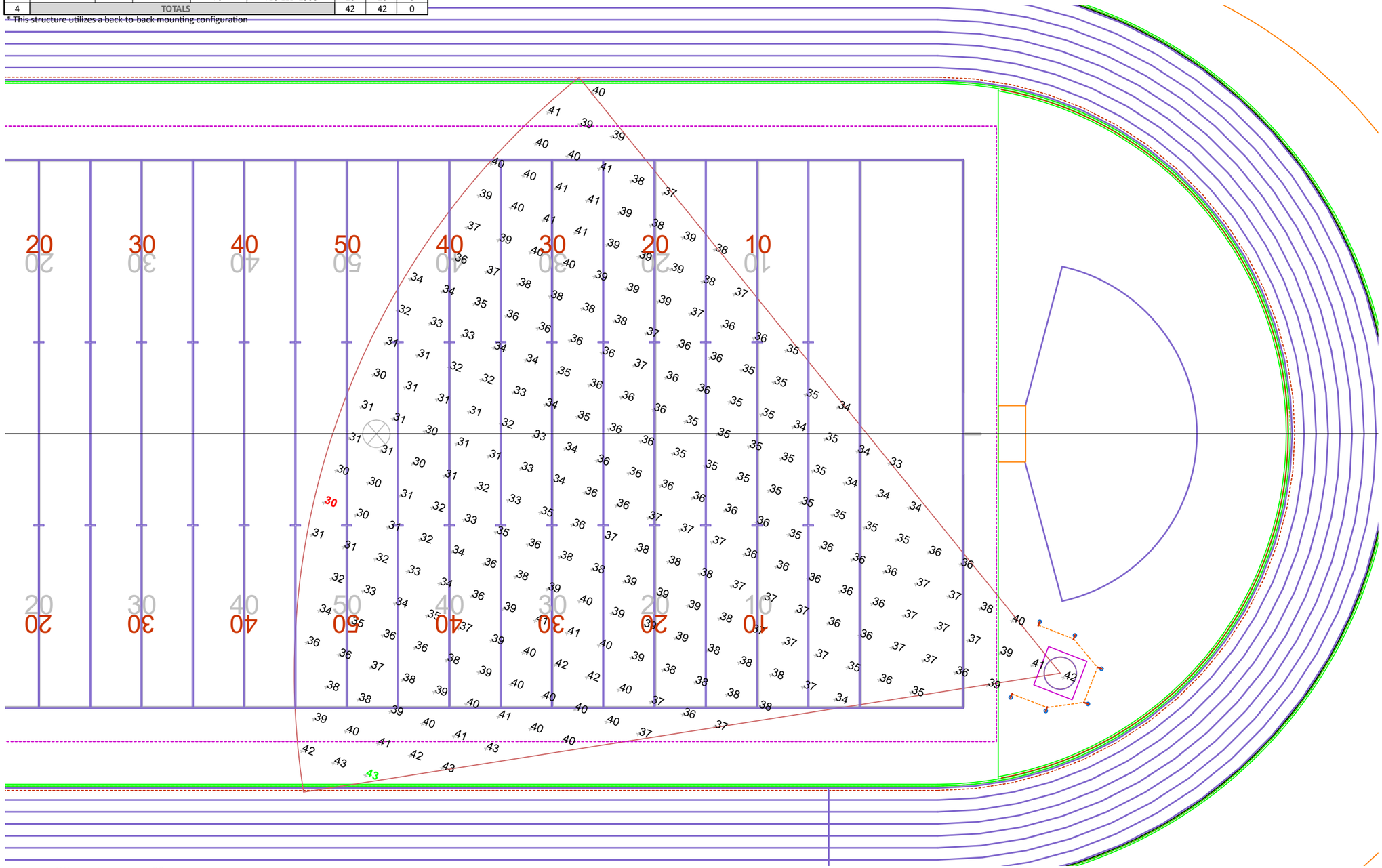
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

* This structure utilizes a back-to-back mounting configuration



Worth County HS

Sylvester, GA

GRID SUMMARY

Name:	**Discus**
Size:	Irregular
Spacing:	10.0' x 10.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**36.42**
Maximum:	43.2
Minimum:	30.3
Avg / Min:	1.20
Max / Min:	**1.43**
UG (adjacent pts):	1.08
CU:	0.15
No. of Points:	265

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	160,000 / 52,000 / 65,600 lumens
No. of Luminaires:	**42**
Total Load:	58.36 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1500	>120,000	>120,000	>120,000
TLC-BT-575	>120,000	>120,000	>120,000
TLC-LED-600	>120,000	>120,000	>120,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

SCALE IN FEET 1 : 30

0' 30' 60'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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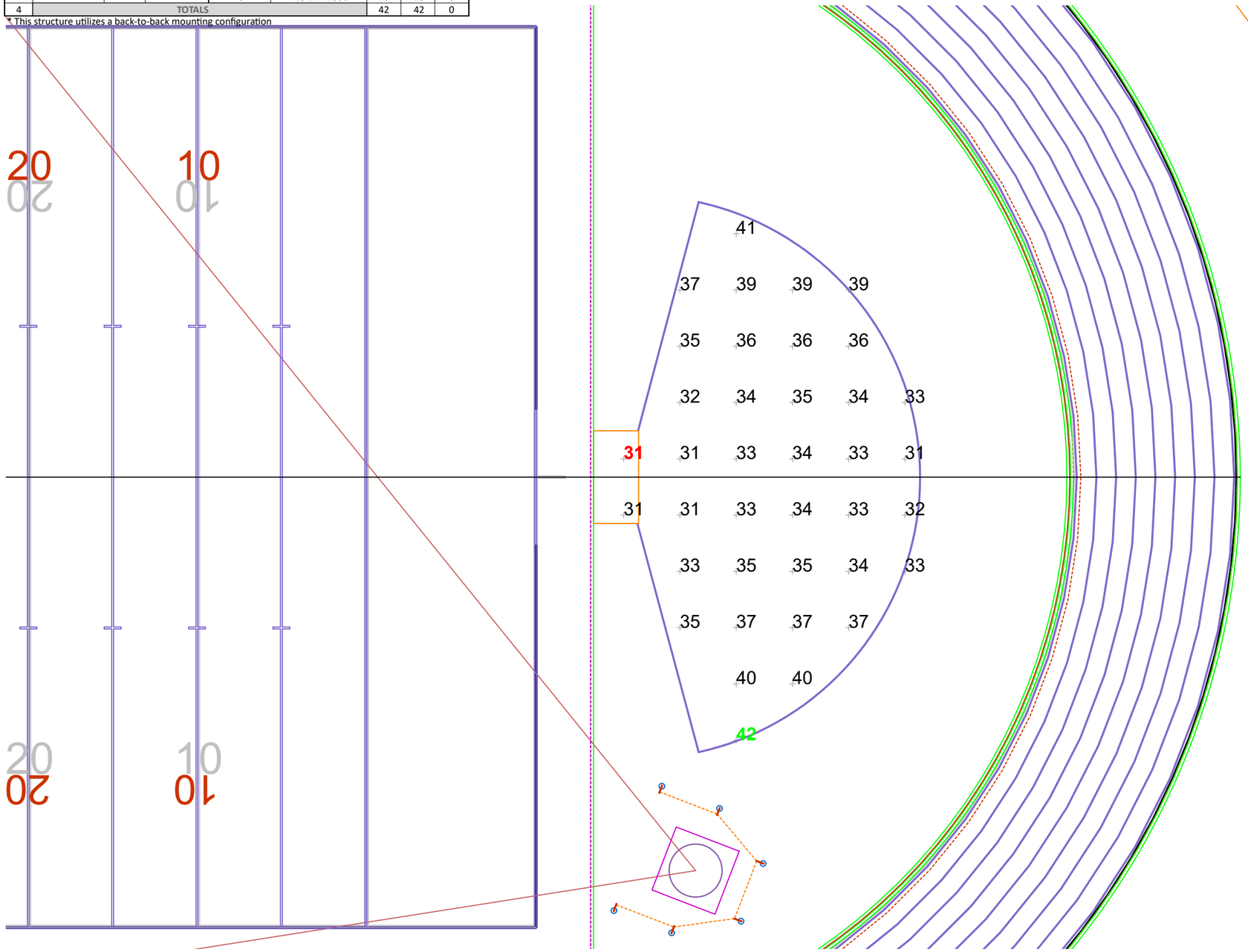
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

* This structure utilizes a back-to-back mounting configuration



SCALE IN FEET 1 : 20

0' 20' 40'

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Worth County HS

Sylvester, GA

GRID SUMMARY

Name:	**High Jump**
Size:	Irregular
Spacing:	10.0' x 10.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**34.98**
Maximum:	42.0
Minimum:	30.8
Avg / Min:	1.14
Max / Min:	**1.36**
UG (adjacent pts):	1.08
CU:	0.02
No. of Points:	38

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	160,000 / 52,000 / 65,600 lumens
No. of Luminaires:	**42**
Total Load:	58.36 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1500	>120,000	>120,000	>120,000
TLC-BT-575	>120,000	>120,000	>120,000
TLC-LED-600	>120,000	>120,000	>120,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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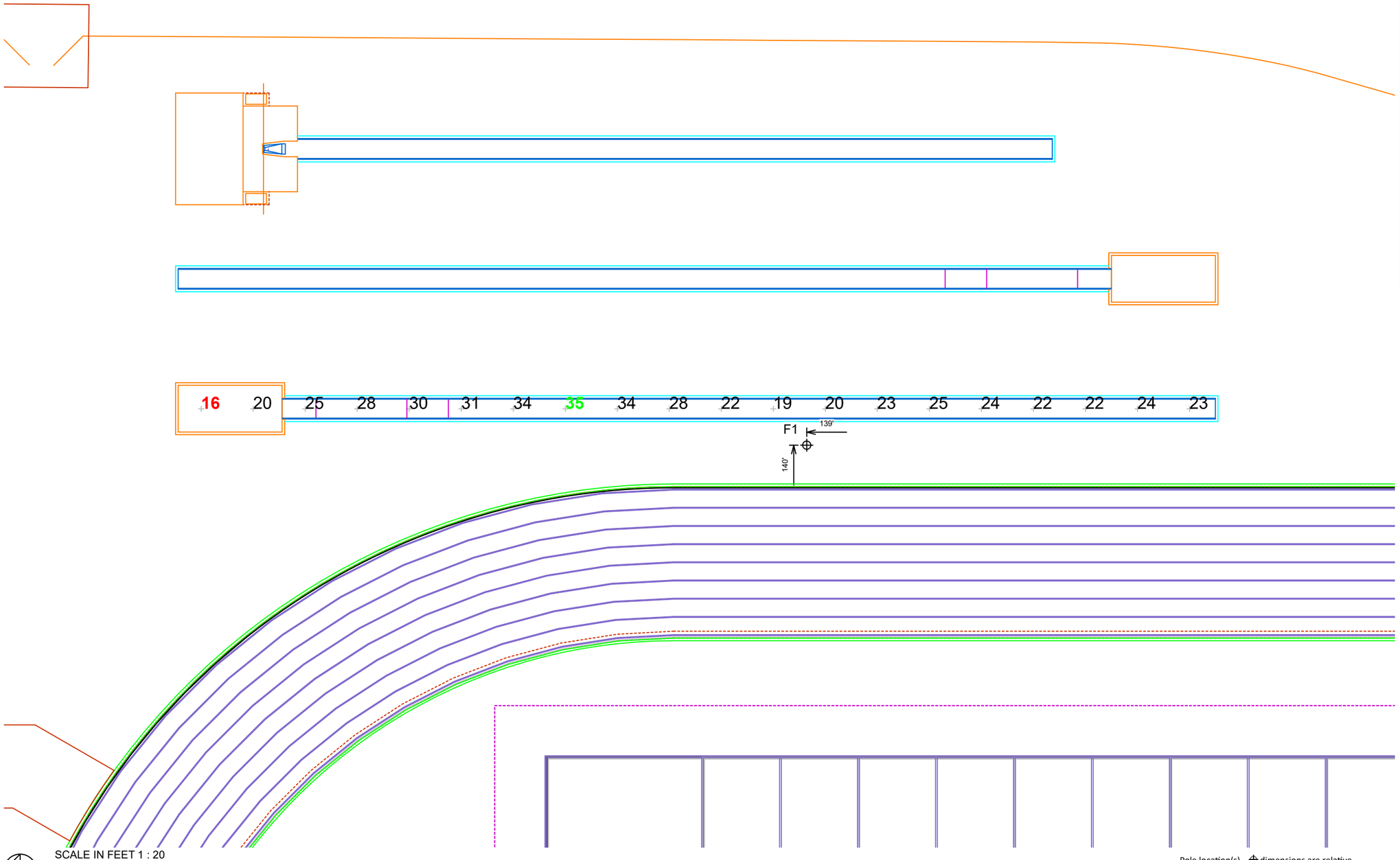
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

* This structure utilizes a back-to-back mounting configuration



Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

Worth County HS

Sylvester, GA

GRID SUMMARY

Name:	**Long Jump**
Size:	Irregular
Spacing:	10.0' x 10.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**25.19**
Maximum:	35.1
Minimum:	16.2
Avg / Min:	1.56
Max / Min:	**2.17**
UG (adjacent pts):	1.29
CU:	0.01
No. of Points:	20

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	160,000 / 52,000 / 65,600 lumens
No. of Luminaires:	**42**
Total Load:	58.36 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1500	>120,000	>120,000	>120,000
TLC-BT-575	>120,000	>120,000	>120,000
TLC-LED-600	>120,000	>120,000	>120,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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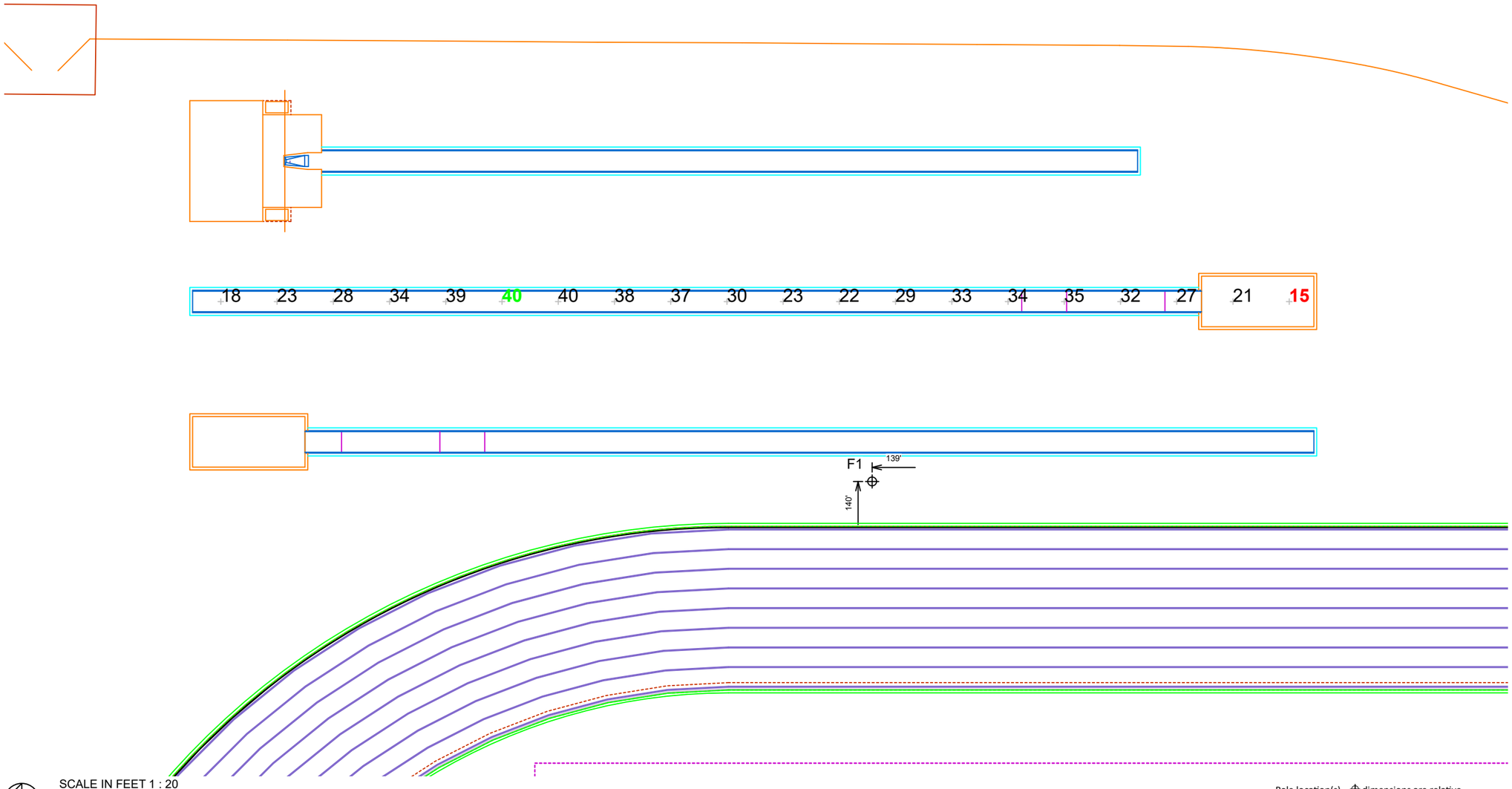
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

* This structure utilizes a back-to-back mounting configuration



Worth County HS

Sylvester, GA

GRID SUMMARY

Name:	**Triple Jump**
Size:	Irregular
Spacing:	10.0' x 10.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**29.80**
Maximum:	39.6
Minimum:	14.8
Avg / Min:	2.01
Max / Min:	**2.68**
UG (adjacent pts):	1.40
CU:	0.01
No. of Points:	20

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	160,000 / 52,000 / 65,600 lumens
No. of Luminaires:	**42**
Total Load:	58.36 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1500	>120,000	>120,000	>120,000
TLC-BT-575	>120,000	>120,000	>120,000
TLC-LED-600	>120,000	>120,000	>120,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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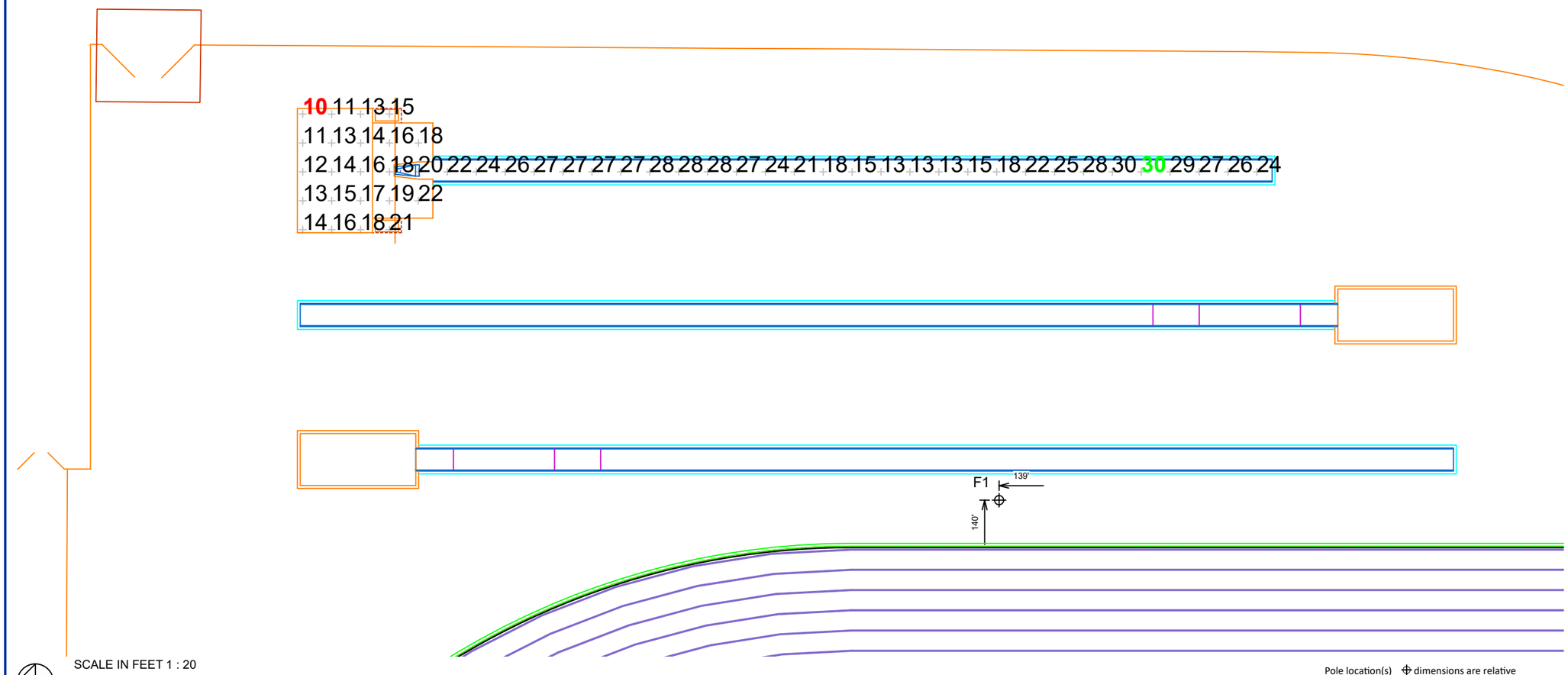
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

* This structure utilizes a back-to-back mounting configuration



SCALE IN FEET 1 : 20

0' 20' 40'

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Worth County HS

Sylvester, GA

GRID SUMMARY

Name:	**Pole Vault**
Size:	Irregular
Spacing:	5.0' x 5.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**20.04**
Maximum:	30.4
Minimum:	10.0
Avg / Min:	2.01
Max / Min:	**3.05**
UG (adjacent pts):	1.22
CU:	0.00
No. of Points:	52

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	160,000 / 52,000 / 65,600 lumens
No. of Luminaires:	**42**
Total Load:	58.36 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1500	>120,000	>120,000	>120,000
TLC-BT-575	>120,000	>120,000	>120,000
TLC-LED-600	>120,000	>120,000	>120,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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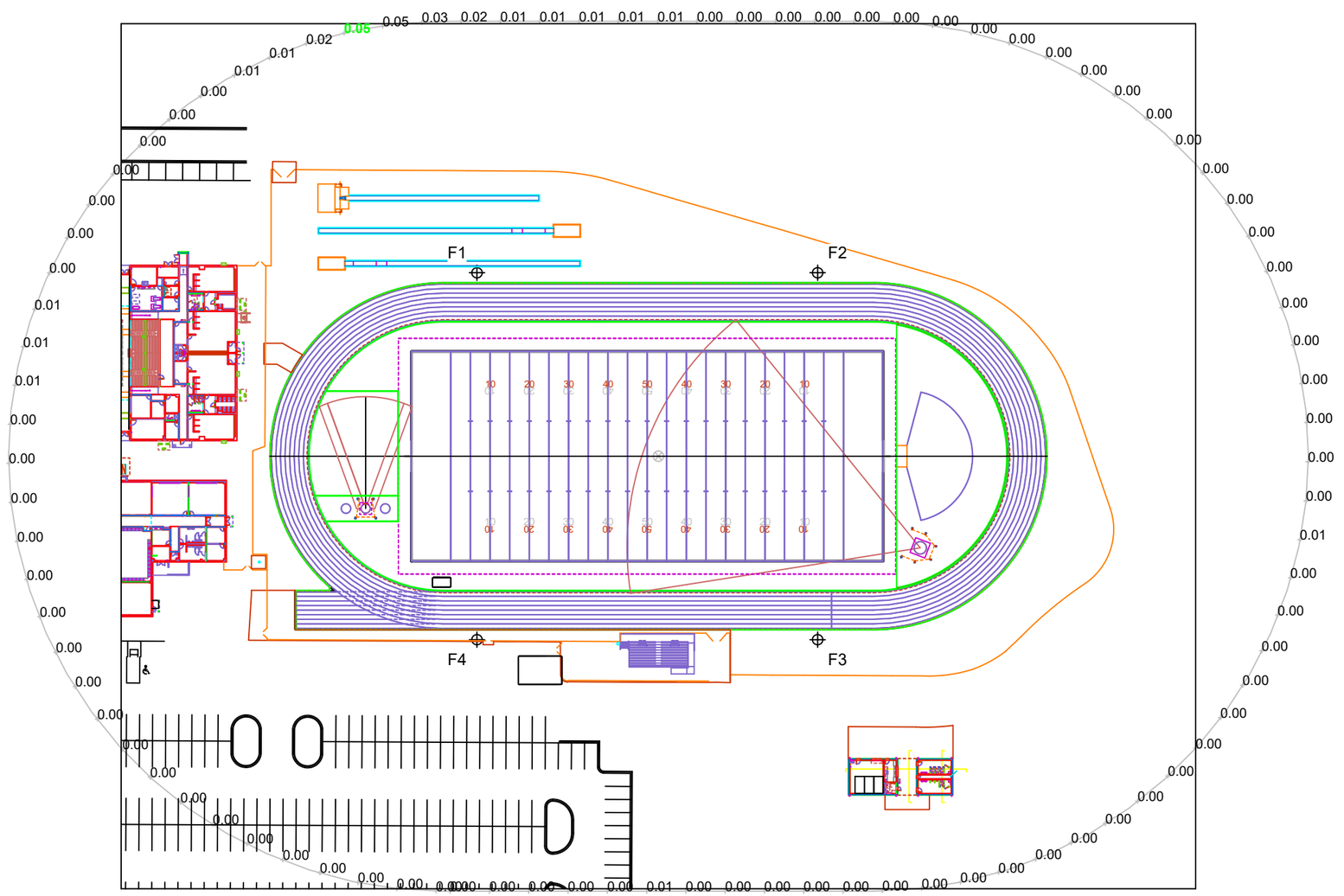
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

* This structure utilizes a back-to-back mounting configuration



SCALE IN FEET 1 : 100

0' 100' 200'

ENGINEERED DESIGN By: JWinegar • File #205129D • 08-Apr-20

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

Worth County HS

Sylvester, GA

GRID SUMMARY

Name:	**Stadium Spill/Glare - 200'**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**0.0042**
Maximum:	0.048
Minimum:	0.000
No. of Points:	92

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	160,000 / 52,000 / 65,600 lumens
No. of Luminaires:	**42**
Total Load:	58.36 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1500	>120,000	>120,000	>120,000
TLC-BT-575	>120,000	>120,000	>120,000
TLC-LED-600	>120,000	>120,000	>120,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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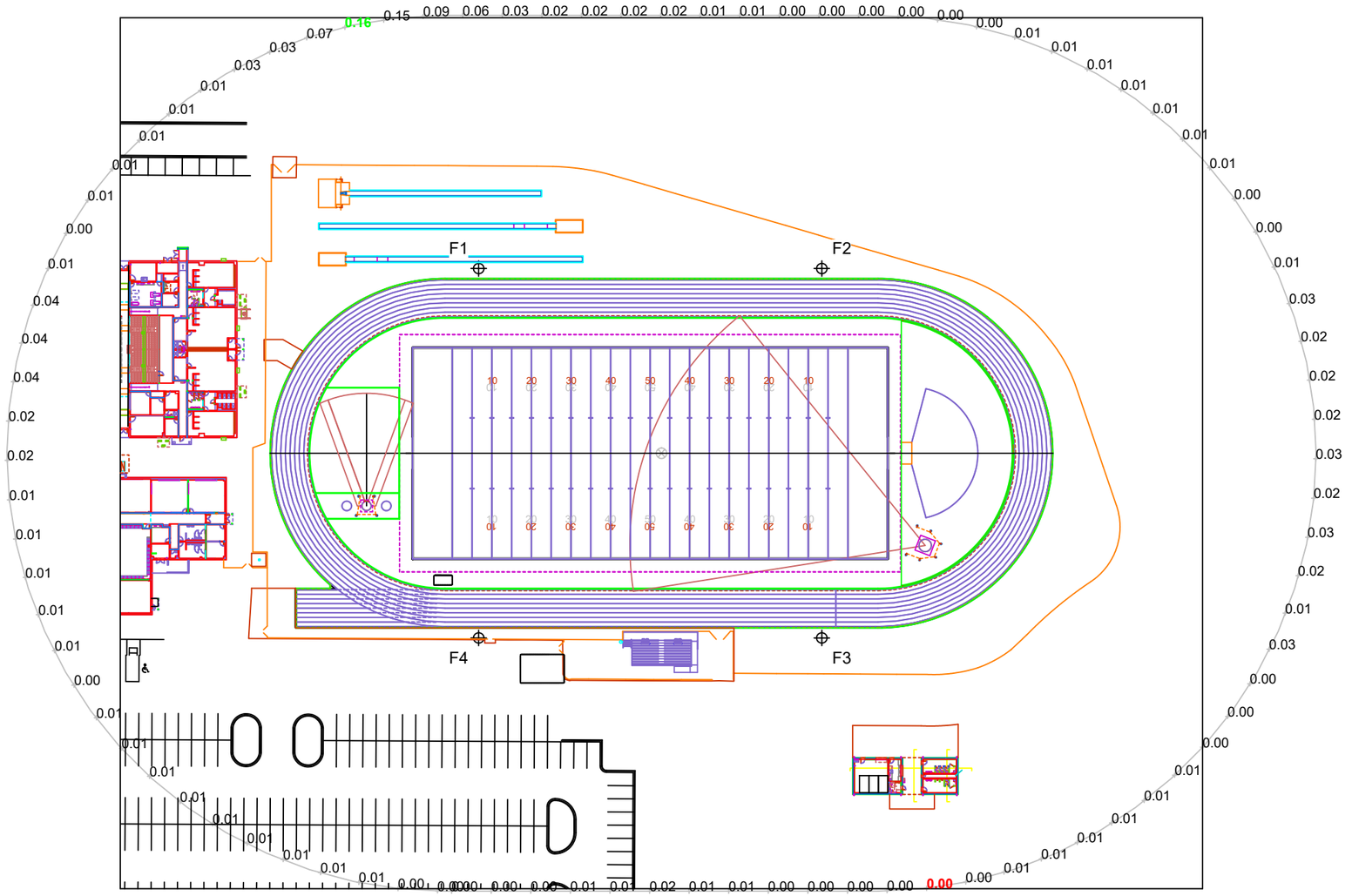
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

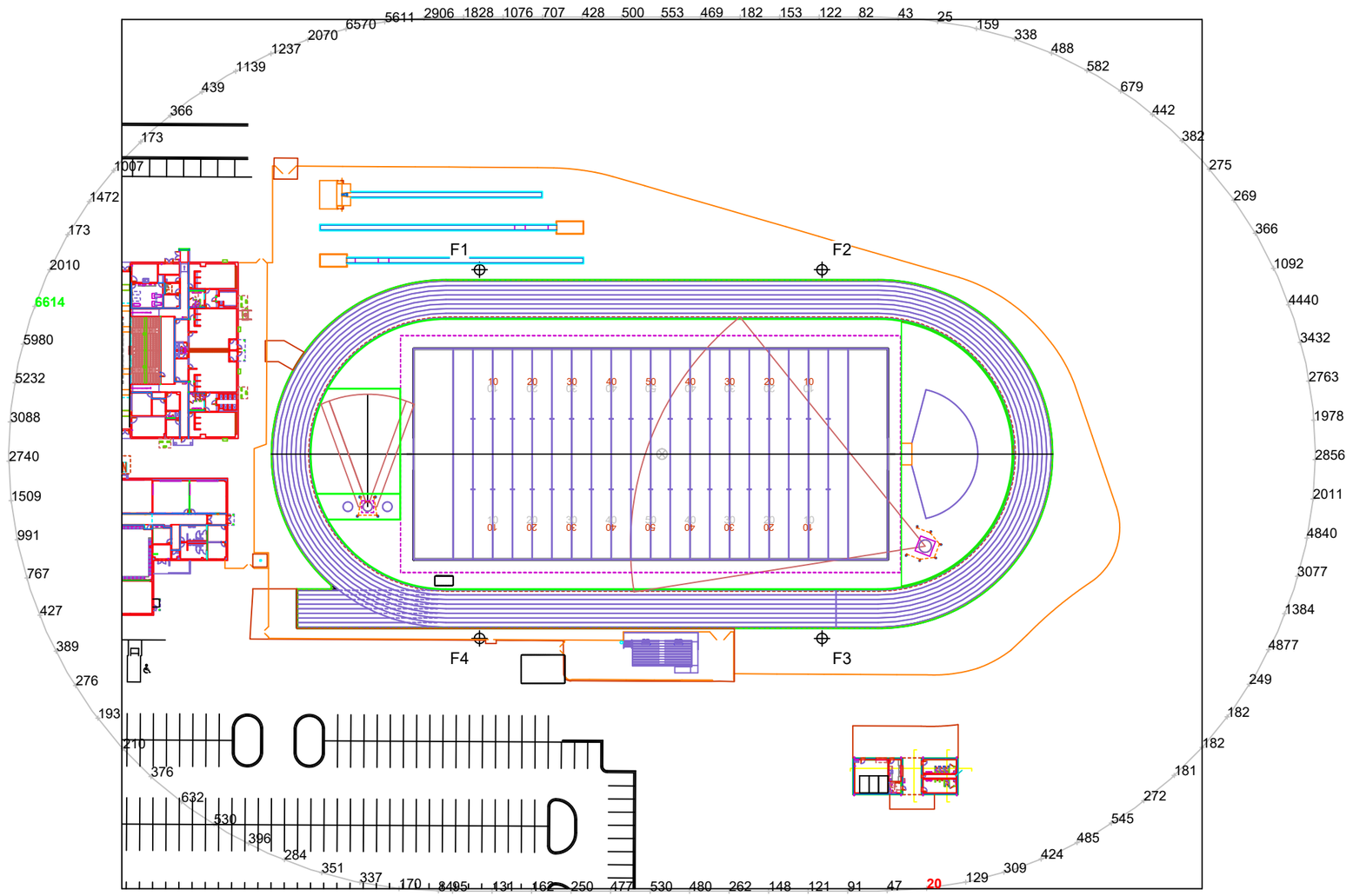
* This structure utilizes a back-to-back mounting configuration


F1
F2
F3
F4
0.16
0.15 0.09 0.06 0.03 0.02 0.02 0.02 0.02 0.01 0.01 0.00 0.00 0.00 0.00 0.00
0.00 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.00 0.00 0.01 0.03 0.02 0.02 0.03 0.02 0.01 0.03 0.00 0.00 0.01 0.01 0.01 0.01 0.01 0.00
0.07 0.03 0.03 0.01 0.01 0.01 0.01 0.01 0.01 0.01

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	F1	70'	-	70'	TLC-LED-1500	9/3*	12	0
1	F2	70'	-	70'	TLC-LED-1500	9	9	0
1	F3	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	9	9	0
1	F4	70'	-	60'	TLC-LED-600	1	1	0
				70'	TLC-LED-1500	10	10	0
4	TOTALS					42	42	0

* This structure utilizes a back-to-back mounting configuration



SCALE IN FEET 1 : 100

0' 100' 200'

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Worth County HS

Sylvester, GA

GRID SUMMARY

Name:	**Stadium Spill/Glare - 200'**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

CANDELA (PER FIXTURE)

	Entire Grid
Scan Average:	**1145.8475**
Maximum:	6614.419
Minimum:	20.471
No. of Points:	92

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	160,000 / 52,000 / 65,600 lumens
No. of Luminaires:	**42**
Total Load:	58.36 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1500	>120,000	>120,000	>120,000
TLC-BT-575	>120,000	>120,000	>120,000
TLC-LED-600	>120,000	>120,000	>120,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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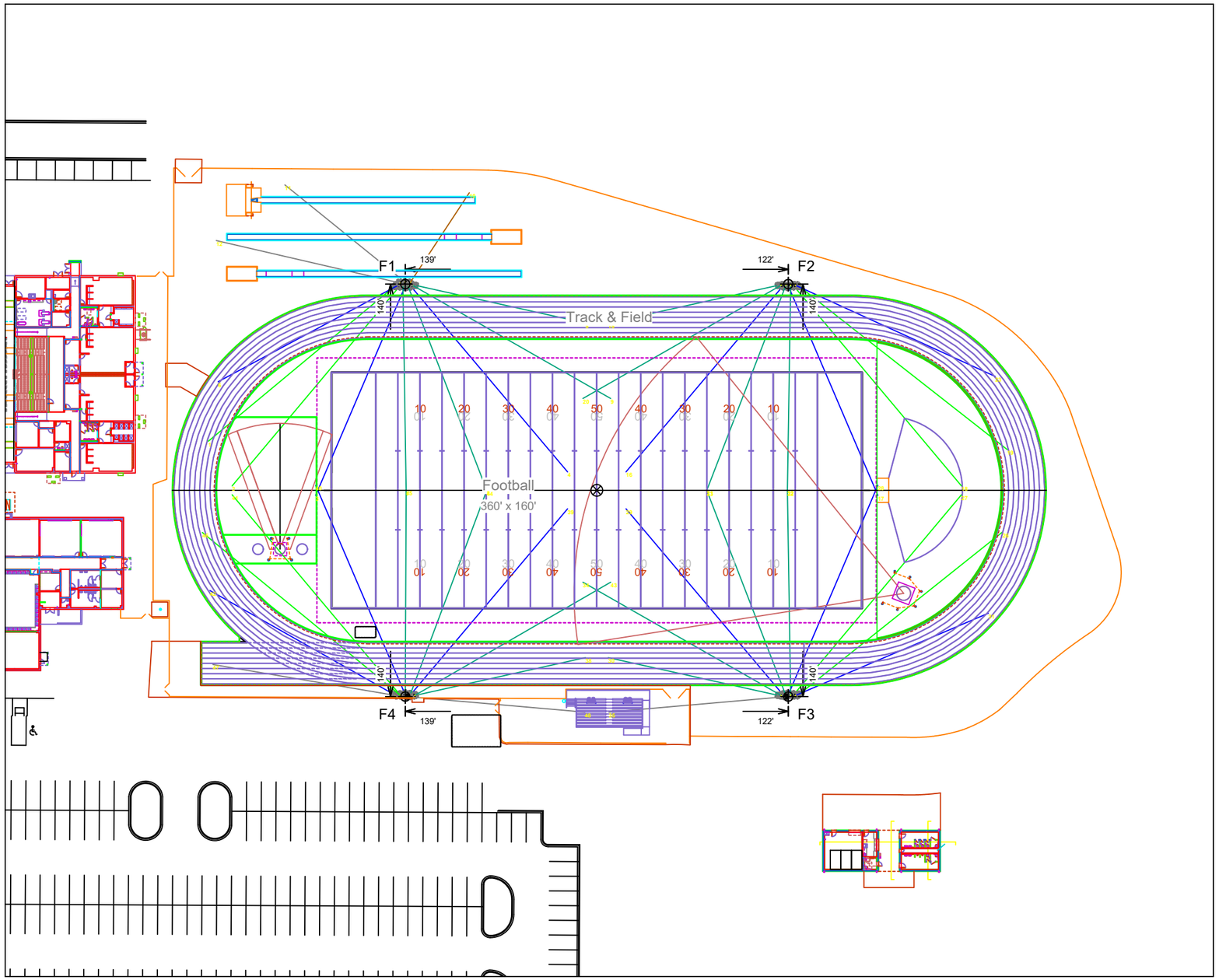
Worth County HS

Sylvester, GA



EQUIPMENT LAYOUT

INCLUDES:
· Football
· Track & Field

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires		
QTY	LOCATION	CLASS	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE
1	F1	LSS70D	-	70'	TLC-LED-1500	9/3*
1	F2	LSS70C	-	70'	TLC-LED-1500	9
1	F3	LSS70D	-	60' 70'	TLC-LED-600 TLC-LED-1500	1 9
1	F4	LSS70D	-	60' 70'	TLC-LED-600 TLC-LED-1500	1 10
4	TOTALS					42

* This structure utilizes a back-to-back mounting configuration

SINGLE LUMINAIRE AMPERAGE DRAW CHART

Ballast Specifications (.90 min power factor)	Line Amperage Per Luminaire (max draw)						
Single Phase Voltage	208 (60)	220 (60)	240 (60)	277 (60)	347 (60)	380 (60)	480 (60)
TLC-LED-1500	8.5	8.1	7.4	6.4	5.1	4.7	3.7
TLC-LED-600	3.4	3.2	3.0	2.6	2.0	1.9	1.5

SCALE IN FEET 1 : 80

0' 80' 160'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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<UTF-8>

Control System Summary

Project Specific Notes:

Project Information

Project #:	205129
Project Name:	Worth County High School New Track
Date:	04/08/20
Project Engineer:	Jackson Winegar
Sales Representative:	Jordan Pierce
Control System Type:	Control-Link™ Control and Monitoring System
Communication Type:	PowerLine-ST
Scan:	205129D
Document ID:	205129P1V2-0408085007
Distribution Panel Location or ID:	Service 1
Total # of Distribution Panel Locations for Project:	1
Design Voltage/Hertz/Phase:	480/60/3
Control Voltage:	120

Equipment Listing

DESCRIPTION	APPROXIMATE SIZE
1.Control and Monitoring Cabinet	24 X 48

	QTY	SIZE (AMPS)
Total Contactors	4	30 AMP
Total Off/On/Auto Switches:	1	

Preliminary Plans
Confirm all Details - voltage,
# of distribution panels, etc.

Materials Checklist

Contractor/Customer Supplied:

- ❑ A dedicated control circuit must be supplied per distribution panel location
  - — If the control voltage is NOT available, a control transformer is required
- ❑ Electrical distribution panel to provide overcurrent protection for circuits
  - — HID rated or D-curve circuit breaker sized per full load amps on Circuit Summary by Zone Chart
- ❑ Wiring
  - — See chart on page 2 for wiring requirements
  - — Equipment grounding conductor and splices must be insulated (per circuit)
  - — Lightning ground protection (per pole), if not Musco supplied
- ❑ Electrical conduit wireway system
  - — Entrance hubs rated NEMA 4, must be die-cast zinc, PVC, or copper-free die-cast aluminum
- ❑ Mounting hardware for cabinets
- ❑ Breaker lock-on device to prevent unauthorized power interruption to control power and powerline connection (if present)
- ❑ Anti-corrosion compound to apply to ends of wire, if necessary

Call Control-Link Central™ operations center at 877/347-3319 to schedule activation of the control system upon completion of the installation.

Note: Activation may take up to 1 1/2 hours.

IMPORTANT NOTES

1. Please confirm that the design voltage listed above is accurate for this facility. Design voltage/phase is defined as the voltage/phase being connected and utilized at each lighting pole's electrical components enclosure disconnect. Inaccurate design voltage/phase can result in additional costs and delays. Contact your Musco sales representative to confirm this item.
2. In a 3 phase design, all 3 phases are to be run to each pole. When a 3 phase design is used Musco's single phase luminaires come pre-wired to utilize all 3 phases across the entire facility.
3. One contactor is required for each pole. When a pole has multiple circuits, one contactor is required for each circuit. All contactors are 100% rated for the published continuous load. All contactors are 3 pole.
4. If the lighting system will be fed from more than one distribution location, additional equipment may be required. Contact your Musco sales representative.
5. A single control circuit must be supplied per control system.
6. Size overcurrent devices using the full load amps column of the Circuit Summary By Zone chart- Minimum power factor is 0.9.

NOTE: Refer to Installation Instructions for more details on equipment information and the installation requirements.

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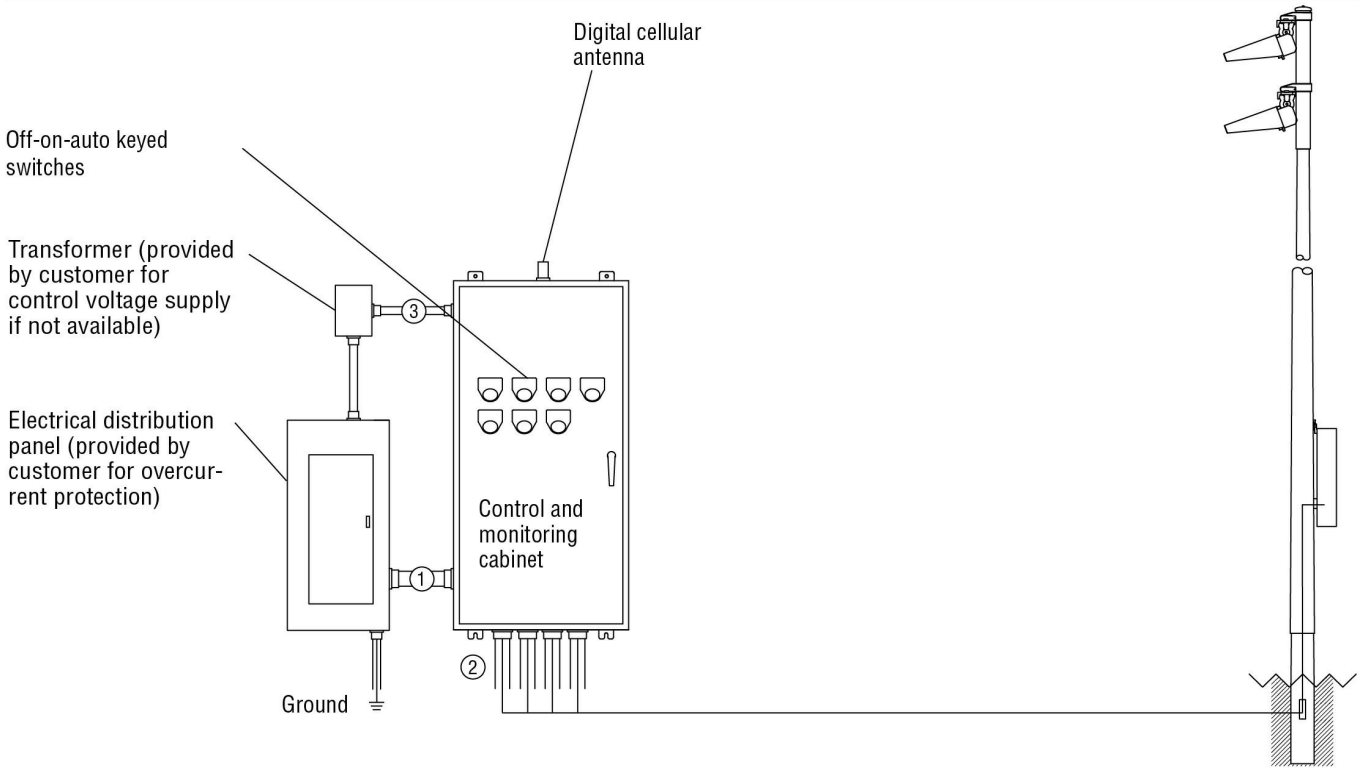
Control System Summary

Control•Link®
Control and Monitoring System



Conduit ID	Description	# of Wires	Wire (AWG)	Conduit (in)	Max. Wire Length (ft)	MUSCO Supplied	Notes
1	Line power to contactors, and equipment grounding conductor	*A	*B	*C	N/A	No	A-E
1	Power-line Communication Connection (dedicated, 20A)	*A	12	*C	N/A	No	A-E
2	Load power to lighting circuits, and equipment grounding conductor	*A	*B	*C	N/A	No	A-E
3	Control power (dedicated, 20A)	3	12	*C	N/A	No	C,E

* Notes:

R60-100-00_A

A. See voltage and phasing per the notes on cover page.
B. Calculate per load and voltage drop.
C. All conduit diameters should be per code unless otherwise specified to allow for connector size.
D. Equipment grounding conductor and any splices must be insulated.
E. Refer to control and monitoring system installation instructions for more details on equipment information and the installation requirements.

IMPORTANT: Control wires (3) must be in separate conduit from line and load power wires (1, 2).

Control System Summary

SWITCHING SCHEDULE

Field/Zone Description	Zones
Football	1

CONTROL POWER CONSUMPTION	
120V Single Phase	
VA loading of Musco Supplied Equipment	INRUSH: 1553.0
	SEALED: 179.8

CIRCUIT SUMMARY BY ZONE

POLE	CIRCUIT DESCRIPTION	# OF FIXTURES	# OF DRIVERS	*FULL LOAD AMPS	CONTACTOR SIZE (AMPS)	CONTACTOR ID	ZONE
F1	Football	12	12	**25.6**	30	C1	1
F2	Football	9	9	**19.2**	30	C2	1
F3	Football	10	10	**20.5**	30	C3	1
F4	Football	11	11	**23.7**	30	C4	1

*Full Load Amps based on amps per driver.

Control System Summary

PANEL SUMMARY

CABINET #	CONTROL MODULE LOCATION	CONTACTOR ID	CIRCUIT DESCRIPTION	FULL LOAD AMPS	DISTRIBUTION PANEL ID (BY OTHERS)	CIRCUIT BREAKER POSITION (BY OTHERS)
1	1	C1	Pole F1	25.63		
1	1	C2	Pole F2	19.23		
1	1	C3	Pole F3	20.51		
1	1	C4	Pole F4	23.71		

ZONE SCHEDULE

			CIRCUIT DESCRIPTION	
ZONE	SELECTOR SWITCH	ZONE DESCRIPTION	POLE ID	CONTACTOR ID
Zone 1	1	Football	F1 F2 F3 F4	C1 C2 C3 C4

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SECTION 27 0200

PERFORMANCE SOUND SYSTEM

1.01 SUBMITTALS

A. Shop drawings shall be submitted as follows:
   1. Manufacturer's published literature.
   2. One line schematic diagram covering the complete system.

B. Sound Contractor shall submit a certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval and that he maintains a fully equipped and stocked service shop and shall respond to service calls within 12 normal working hours.

1.02 MANUFACTURERS

A. The acceptable manufacturers systems listed shall be installed by the authorized local factory dealer/representative for that product. The factory dealer representative shall hold a current low voltage contractor's license.

   Any interested parties shall submit a company resume showing years in business, certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval and that he maintains a fully equipped and stocked service shop and shall respond to service calls within 12 normal working hours, list of key personnel, copies of appropriate licenses and list of recently completed jobs during the normal prior approval period.

1.03 SCOPE

A. The work to be provided under this section consists of furnishing and installing A Soccer Field/Track Performance Sound system equipment, cable and labor necessary for a complete and operating system as shown on the drawings and specified herein.

1.04 GENERAL REQUIREMENTS

A. All equipment shall bear the label of Underwriter's Laboratories and be listed for use under their re-examination service.

B. All work shall be accomplished by an accredited factory trained communication technician. He shall also train personnel designated by the Owner in the proper operation and maintenance of equipment. All work in conjunction with this installation shall be in accordance with the engineering standards as established by EIA. All wiring shall be as recommended by manufacturer furnishing equipment except that each pair of cable shall be individually shielded. The manufacturer of this equipment shall provide a complete set of operating instructions, circuit diagrams and other information necessary for proper installation, operation and maintenance of the system. Three copies of the operating instructions shall be furnished to the Owner upon completion of the

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installation. All communications and program control systems shall be installed as a single system using common conduits and outlets. The complete system as herein specified shall be guaranteed to be free of defects in material and workmanship for a period of two (2) years from the date of acceptance.

C. All equipment shall include all required mounting equipment, components, cabling, programming, testing, balancing, Owner training for a completely operational system.

1.05 EQUIPMENT – PERFORMANCE SOUND SYSTEMS

A. Outdoor Sports Field Loudspeakers (Speaker Type 1) – (With Factory Pole Mount Accessories)
   1. Danley Labs – OS 80
   2. JBL – AW295
   3. Community –R.5-Max

B. Lockable Equipment Cabinet – Size to accommodate required equipment in each location.
   1. Middle Atlantic Products- DWR Series
   2. Lowell – L250 Series
   3. Tripp Lite – SR Series

C. Processor / Automated Microphone Mixer (Quantity as required to meet each location's input channel requirements. Automated microphone mixing required for automated operation.)
   1. Ashly - ne8800MC
   2. BSS – Soundweb London BLU-80

D. Processor Remote (Shall be compatible with processor installed)
   1. Ashly – FR-16 w/ rack kit
   2. BSS – BLU-10

E. PoE Unmanaged Hardened Network Switch
   1. Crestron – CEN-SW-PoE-5
   2. Blackbox – Extreme PoE PSE Switch
   3. Moxa – EDS-P206A

F. CD Player (Rackmount)
   1. Yamaha – CD-S300 RK
   2. Denon – DN-501C
   3. Marantz – CD5005

G. Wireless Handset Microphones
   1. Shure - QLXD24-SM87 with Lithium SB900 Rechargeable Battery and Charger (No Equals)

H. Wireless Headset Microphone
   1. Shure – QLXD14-MX153T with Lithium SB900 Rechargeable Battery and Charger (No Equals)

I. Wireless Microphone Antenna Cable

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1. Shure RG13/U UA8100 – No Equals

J. Wireless Microphone Active Antenna Splitter
1. Shure UA845SWB – No Equals

K. Wireless Microphone Passive Antenna Combiner
1. Shure UA221 – No Equals

L. Wireless Microphone Extension Antenna
1. Shure UAS-470-542 – No Equals

M. Wireless Microphone Antenna Mount
1. Shure UA505 – No Equals

N. Amplifiers (Quantity as required for maximum of two (2) speakers per amplifier channel)
1. Ashly- KLR3200
2. Yamaha Pro Audio – XP3500
3. Danley Labs – DSLA 1.7K

O. Power Strip
1. Tripp Lite
2. APC
3. Para Systems

P. Wired Microphones
1. Shure – SM48S
2. Electro Voice – N/D367s
3. AKG - D 5

Q. Microphone Cable
1. Pro Co – EXM 25
2. RapcoHorizon – M1-25
3. Hosa – HMIC025

R. Input Balancing Transformers
1. Radio Design Labs – D-CIJ3
2. Jensen – DB-2RM-WP

S. Microphone Input (2XLR Decora)
1. RDL – DS XLR2F
2. RCI – D-CIJ3C

T. Microphone Cabling
1. West Penn 22-2 Plenum Shielded Mic Cable – 25291B

U. Speaker Cabling
1. West Penn 12-2 Plenum Speaker Cable – 25227B

V. Power Sequencer
1. Furman – PS-8R

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2. Lowell – RPC-3N1

W. Microphone Cabling
1. West Penn 22-2 Plenum Shielded Mic Cable 0 25291B

X. Assistive Listening Device
1. Assistive Listening
2. Adaptive Concepts

1.06 REQUIREMENTS – PERFORMANCE SOUND SYSTEMS

A . Soccer Field/Track
1. Main Outdoor Loudspeakers (Speaker Type 1) – Qty 4
2. Lockable Equipment Cabinet – As Required
3. Processor / Automated Microphone Mixer – Qty to match inputs
4. Processor Remote – Qty 1
5. PoE Unmanaged Hardened Network Switch – Qty 1
6. CD Player – Qty 1
7. Wireless Handset Mic – Qty 2
8. Wireless Headset Mic – Qty 2
9. Amplifiers—Qty 4
10. Power Strip – Qty 1
11. Wired Microphones – Qty 2
12. Microphone Cable – Qty 2
13. Input Balancing Transformers – Qty 1
14. Microphone Input (Dual) – Qty 1
15. Microphone Cabling – As Required
16. Speaker Cabling- As Required
17. Power Sequencer – Minimum 1 (Qty as Required)

1.08 EQUIPMENT AND CABLE INSTALLATION

A. Installation of sound reinforcement system shall be performed only by experienced electronic system installer.

B. Cable within equipment racks shall be routed in groups according to functions: control circuits, microphone circuits, line level circuits, loudspeaker circuits, and 120 VAC circuits. Cable shall be neatly arranged, but tight bundling which makes modifications difficult shall be avoided.

C. Pressure sensitive labels shall be affixed to cables at all termination points. Label method shall be indicated on record drawings.

D. Care shall be exercised in wiring so as to avoid damage to the cables and to the equipment. All wire joints and connections shall be made with resincore solder and small soldering iron or approved mechanical connectors. Soldering shall be neat and care must be taken to avoid "cold" solder joints. Splices in circuits shall be avoided. Conn ections to screw-type terminals shall be made with mechanically connected, un-insulated, spade-type lugs selected for the particular wire size in use and crimped.

E. All cable pairs shall be individually shielded. All cabling not in conduit shall be plenum rated.

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F. The Contractor shall ground the equipment racks via a #6 AWG insulated cable to earth ground.

G. All wiring above ceiling may be run exposed, when run exposed, or in areas with no acoustical tile ceiling or for vertical or in wall runs they shall be run in conduit.

END OF SECTION

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SECTION 27 0210

DATA/VOICE NETWORK AND CABLING SYSTEM

1.01 SUBMITTALS

A. Shop drawings shall be submitted as follows:
   1. Manufacturer's published literature for each separate type of equipment provided. Indicate model number on cutsheet.
   2. One line schematic of complete system showing a floor plan to scale. Show locations and the type of outlets, as well as all rack locations, and cabling type.
   3. Documentation of testing on all wiring and terminations as per ANSI/TIA standards.

1.02 MANUFACTURERS

A. Acceptable manufacturers for each type of equipment specified shall be as noted throughout this specification section.

B. The acceptable manufacturers noted shall be installed by the authorized local factory dealer/representative for that product.

C. The contractor shall hold a current low voltage contractor's license and RCDD certificate. Any other interested parties shall submit a company resume showing years in business, certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval and that he maintains a fully equipped and stocked service shop and shall respond to service calls within 12 normal working hours, list of key personnel, copies of appropriate licenses and list of recently completed jobs. Submittal must be received no later than ten business days prior to bid date in order to be considered.

1.03 GENERAL

A. Workmanship

All work shall be performed in a workmanlike manner. Architect, Engineer, and/or Owner may observe the work procedures and workmanship of the Contractor but such observation will not relieve the contractor from responsibility for performance.

B. Warranty

The Contractor shall furnish a written warranty that describes the equipment supplied under these specifications will be free from defects of materials and workmanship for a period of fifteen years from the date of final acceptance unless otherwise specified and that all defects occurring within that period shall be corrected in a timely manner at no cost to the Owner.

C. Contractor's Qualifications

Contractor shall be required, before awarding of contract, to demonstrate to the complete satisfaction of the Engineer that he has the necessary facilities, ability and financial resources to execute the work in a satisfactory manner and within the time specified; that he has had experience in construction work as same or similar nature; that he has past history and references which will assure the Owner of his qualifications for executing the work.

Contractor shall submit a copy of a valid low-voltage license (Low-Voltage General, Low-Voltage Telecommunications or Low-Voltage Unrestricted as issued by the State Construction Industry Licensing Board of Low-Voltage Contractors).

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Contractor shall submit a copy of a BICSI (Building Industry Consulting Service International) certified RCDD (Registered Communications Distributions Designer) certificate.

D. Comprehensive list of references
Attach a detailed list of references along with contact person, dates of work, mailing address, telephone numbers.

E. Contractor must provide proof of installation in a minimum of five sites using a Category 6 structured cabling with 100 or more active (working) nodes installed.

1.04 SCOPE OF WORK

A. Scope of Project Standards and Description

The cabling and wiring placed for voice and data communications on this undertaking shall be "Unshielded Twisted Pair" type and conform to the requirements contained in the latest editions of the National Electric Code (NEC) and the latest editions of the following American National Standards Institute (ANSI) specifications:

1. ANSI/TIA 568-Commercial Building Telecommunications Cabling Standard
2. TIA 569-Commercial Building Standard for Telecommunications Pathways and Spaces
3. ANSI/TIA/EIA 606-Administration Standard for Commercial Telecommunications Infrastructure
4. ANSI/J-STD 607-Commercial Building Grounding (earthing) and Bonding Requirements for Telecommunications
5. Addendums to TIA/EIA 568

B. Specifications for the Fiber Optic Backbone, Jacks, Outlets, Horizontal Wiring, Patch Panel, UPS, and Racks are provided in this specification section. Electronics are provided by Owner.

1.05 GUARANTEES

A. All communication outlets wired and serviceable must be tested and certified in compliance with ANSI/TIA 568-C.2-1 Category 6 specifications. Testing must be "end-to-end". Test results shall be forwarded to Engineer a minimum of one week prior to final inspection.

1.06 TESTING AND CERTIFICATION

A. Testing fiber optic and copper distribution systems are crucial in assuring the overall integrity and satisfactory performance of the network. Test results quantify system quality, identify system faults, and establish the baseline accountability performance of the system. Proper testing also maximizes the longevity of the system, minimizes downtime and maintenance, and facilitates system upgrades or reconfiguration.

B. The Contractor shall provide proof of communications wiring systems certification and testing certification.

C. All data and voice wiring and terminations shall be tested and must pass ANSI/TIA standards for Category 6 Cabling. All faults shall be corrected.

D. All test results must be printed and show the following primary results:

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1. Wire map
2. Length
3. Insertion Loss
4. Near-end crosstalk (NEXT)
5. Power sum near end crosstalk (PSNEXT)
6. Equal-level far-end crosstalk (ELFEXT)
7. Power sum equal-level far-end crosstalk (PSELFEXT)
8. Return Loss
9. Propagation delay

1.07 FIBER OPTIC BACKBONE

A. Fiber optic cable shall be provided for backbone inter-building and intra-building wiring. This includes all MDF to IDF and vertical riser applications.

1. Multilmode: All multimode fiber optic cabling used shall be 850nm, laser optimized, OM4, multimode 50 micron core diameter / 125 micron cladding diameter. The multimode fiber optic cable shall meet TIA/EIA 492 AAAB standard. The cable shall meet the requirements of TIA/EIA 568-C.3 standard. As a minimum, backbone and vertical riser cables shall contain 6 fibers. All fibers in each cable must be multimode, with attenuation <3.0 dB loss / km and OFL bandwidth of 3500 MHz-km at 850 nm and attenuation <1.0 dB loss/km and OFL bandwidth of 500 MHz-km at 1300 nm. Cables that provide additional fibers to replace defective fibers in the cable are not permitted. Fiber shall meet TIA/EIA 568-C.3-1 for 10 Gb Ethernet applications. Basis of design is Corning 006TU4-T4790D20 OSP.

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2. All single mode fiber optic cable used shall be OSP rated, OS2, 8.3 micrometers and be loose tube construction. The single mode fiber shall be dispersion unshifted optical fiber that meets ITU-T G.652D requirements. It shall provide optimum performance over entire wavelength range from 1260 to 1625 nanometers and support applications that utilize extended E-band 1360 to 1460 nanometers. It shall also support legacy style mode applications that operate in 1310 and 1550 nanometer ranges. It shall be non armored, gel free, OSP cable. Basis of design is Corning 012ZU4-T4F22D20 OSP.

B. Intra-building fiber optic cabling used to interconnect IDF's and MDF shall be a tight buffered, non gel-filled design composed of all dielectric materials and if not installed in conduit shall be plenum rated and listed as OFNP (UL). Fiber optic cable installed underground shall be water blocked with either gel or dry block and rated for outdoor underground duct installation. Any fiber not installed in conduit, shall be installed in plenum rated innderduct.

1.08 UNINTERRUPTIBLE POWER SUPPLY (UPS) FOR NETWORK ELECTRONICS

A. The network electronics at each IDF rack shall be plugged into an uninterruptible power supply which operates in a hot standby state when the AC power is present, providing power of consistent quality. Also, the switch over time must not be more than 4 microseconds. UPS shall be rack mounted and be a minimum 2150 VA capacity to twice the installed electrical load (UPS should maximum 50% loaded). UPS shall be equal to APC Smart UPS. UPS shall be SNMP equipped and LAN network management card 2 with environmental monitoring.

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1.09 LOCAL AREA NETWORK (LAN) JACK AND OUTLET SPECIFICATIONS

A. Locations shown on drawings will be equipped with a consistent arrangement of LAN communications outlets.

B. Outlet faceplate for this arrangement shall be configured in the following fashion:

1. The jacks used shall fit properly in the outlet openings of the outlet faceplate. The jacks used shall conform to Category 6 parameters of ANSI/TIA 568-C.2-1. Jacks shall be specification grade, made in the USA and furnished as part of an end to end channel solution with horizontal cabling manufacturer.

a. In a properly installed Category 6 UTP cabling system, the jacks used shall be capable of supporting LAN data rates of 1000 Mbps.
b. The wiring arrangement of the jack shall conform to the ANSI/TIA 568.
c. The jack shall possess the following characteristics:

1. The eight (8) position / eight (8) conductor jack shall be capable of supporting the previously defined data rates as well as voice (including ISDN).
2. Utilization of 110 type or equivalent insulation displacement hardware for horizontal wire attachment and acceptance of 22 or 23 AWG conductors.
3. The jack wires shall consist of 50 micro-inch lubricated gold plating over 100 micro-inch nickel underplating.

d. Any vacant faceplate position shall be reserved for future growth and should have a dust cover/blank inserted.

C. Acceptable Manufacturer's: Panduit, Commscope, Molex, Hubbell, AMP, and Ortronics.

D. Each jack shall have faceplate labeled. Also neatly label backside of faceplate with a permanent marker to note jack number.

E. Labeling of multiple drops in a common space shall be sequentially numbered. Numbers shall not be assigned randomly. Coordinate prior to terminating at racks, no exceptions.

1.10 LOCAL AREA NETWORK (LAN) HORIZONTAL WIRING SPECIFICATIONS

A. This section covers the cable from the communications outlet to the patch panel in the IC or wiring closet. These cables shall be Category 6 Unshielded Twisted Pair cable. Each cable shall be placed in a "point-to-point" fashion from the work area outlet to the wiring closet for each communications outlet needed. There shall be no intermediate splices or cross connects in these cables.

B. The characteristics of the horizontal cable are as follows:
1. Category 6 cable consisting of four pair of 23 AWG bare solid copper conductors insulated with a plenum rated material. The insulated conductors are tightly twisted into pairs and jacketed with plenum rated material. No type of shield is required in the sheath.
2. Each sheath shall contain four unshielded copper pairs. Each pair shall have a different twist per foot ratio ranging from 12 to 24 twists per foot.

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No more than 1/2" inch may be untwisted and the sheath may not be stripped back more than 1/2" inch at the jack during installation.

C. The cable component shall meet or exceed the following requirements:
   1. ASNI/TIA 568-C.2 "Commercial Building Telecommunications Standard, Part 2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard"
   2. ASNI/TIA 1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted Pair Cabling "
   3. Certified Category 6 Cable under Third Party Cable Certification Program.
   4. ICEA S-102-700
   5. ANSI/ICEA S-102-732
   6. UL Standard 444
   7. National Electric Code - Article 800

D. Subject to compliance with specification requirements, the only acceptable Cat. 6 cables approved for use as follows:

   1. Mohawk Advancenet
   2. Hittachi HCM Premium
   3. Belden Datatwist 4800
   4. General Cable Genspeed 6000
   5. Berk-Tek Lanmark 1000

E. Plenum rated cable shall be used. The plenum cable shall be composed of four pair of 23 gauge bare solid copper conductors insulated with a plenum rated insulation that is the same material configuration on all four pairs, 3+1 or 2+2 designs are not allowed. The insulated conductors are tightly twisted into pairs and jacketed with low smoke plenum rated PVC. It shall conform to a NEC Type CMP for plenum and NEC Type CMR for riser applications.

1.11 LOCAL AREA NETWORK (LAN) PATCH PANEL SPECIFICATIONS

A. This section covers the termination hardware located in the MDF and IDF (wiring closet). The termination hardware shall provide the capability to be able to patch connections between ports on the LAN hardware (electronics) and the horizontal cables to the work area outlets.

B. The Patch panels shall be Category 6 Modular Jack Panels. Provide 24 port or 48 port patch panels as required for number of drops.

C. The termination hardware will be co-located on 19" inch racks with the LAN electronics. The configuration of the patch panels shall be in an agreement that minimizes patch cord lengths. Provisions for cable management (organization of horizontal and vertical cable and patch cords) on the rack should be included.

D. Horizontal cables to the work area outlets will be directly connected to 110 insulation displacement hardware or equivalent associated with each jack on the patch panel. The jacks on the patch panel shall be wired in accordance with ANSI/TIA 568- C.2 standard.

E. Category 6, factory-built, manufacture tested patch cords shall be provided for <u>each</u> drop. Provide 14' patch cord at station end. Provide patch cord at rack end. (Length as required for electronics to properly lace cords). Provide velcro patch cord wraps for cable management. Patch cords shall be non-booted.

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F. Fiber Termination requirements:

Fiber optics connections should be terminated using a rack mountable Interconnect enclosure or equivalent to insure that the connections are protected. The enclosure should be locked and no fiber cable should be visible in the rack.

G. Fiber connector shall be terminated using “SC” type connectors. Verify with Owner prior to ordering.

H. Acceptable Manufacturer's: AFL, Commscope, General Cable, and Corming.

1.12 LOCAL AREA NETWORK (LAN) RACK SPECIFICATIONS

A. Racks: Communications racks shall be UL listed 7N69. Four-Post Rack shall consist of: (4) vertical rails, (2) base angles, (1) assembly hardware kit, (2) top angles, and (20) #12-24 dog. Two-Post Rack shall consist of: (2) vertical rails, (2) base angles, (1) assembly hardware kit, (2) top angles, and (20) #12-24 dog. All rack design shall be a structural aluminum construction, having 3-inch (76 mm) wide vertical rail channels. Rack to be 19inch “NEXTFRAME” HPW series as manufactured by Hubbell-Premise, 1nc. "C" Channel Vertical Cable Organizers and covers as scheduled. "Z" Channel Vertical Cable Organizers and covers.

B. Wall mounted/undercounter wall cabinets shall

C. Acceptable equal Manufacturer are Mod-Tap, Ortronics, AMP, Leviton, Interlink, Panduit, Siemon Great Lakes, and Hellerman Tyton.

1.13 SYSTEM DOCUMENTATION

A. As part of the wiring system installation, the Contractor shall provide detailed documentation of the distribution system to facilitate system administration, system maintenance and future system changes. This requirement includes as-built drawings with all cables and terminations identified, a bill of materials of all installed equipment and wiring, rack and backboard equipment layouts showing placement of support equipment, and model and serial numbers of all installed equipment. A clear and consistent nomenclature scheme is to be defined and used on the documentation and cable labeling which facilitates locating and identifying each cable.

B. System verification and acceptance documentation signed and dated by the installer (Contractor) and the design professional shall also be provided. This documentation shall include test measurements and system calibrations performed for the entire system. Sample system operations shall also be performed with actual hardware or using contractor provided test equipment and documented to verify that the system is operational and ready for acceptance. This shall also establish the baseline performance of the system.

1.14 TRAINING

A. Training of owner's personnel (a minimum of two) shall be provided. Training will cover the location nomenclature, documentation structure and contents, documentation maintenance procedures, a "walk-through" for location and labeling orientation, system reconfiguration using the MDF, and IDF facilities (Termination hardware, punch blocks, etc.), operation of network equipment installed as part of the contact, test documentation, and trouble shooting of the signal and power cable portion of the installation.

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B. Provide a record set plan noting drop locations and jack designations. As-built shall be a full size plan and shall be computer generated in AutoCAD 2007 format. Provide a CD to Owner with (as-build) on disc at project closeout. At each rack provide a copy of (as-built) mounted on wall. Mount plan under plexiglass.

END OF SECTION

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SECTION 27 1000

DATA/VOICE CONDUIT SYSTEM

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

A. A complete low voltage conduit and outlet system for the data/voice cabling system shall be provided by the contractor.

PART 2 - PRODUCTS

A. Refer to sections 260533 Raceways and Boxes for all conduit system requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The electrical contractor shall coordinate all rough in of all outlet boxes and conduit locations with the Data/Voice Network Cabling contractor.

1. All data/voice outlets are to be installed within six (6”) inches of a receptacle. The electrical contractor shall be responsible for review of cabling drawings and coordinate device locations. Conduit size shown shall be minimum 1” C., 90 degree elbow with plastic bushing, and pull string.

END OF SECTION

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SECTION 28 0513

CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. RS-232 cabling.
2. RS-485 cabling.
3. Low-voltage control cabling.
4. Control-circuit conductors.
5. Fire alarm wire and cable.
6. Identification products.
7. Intrusion Alarm Wire & Cable

1.02 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.
B. EMI: Electromagnetic interference.
C. IDC: Insulation displacement connector.
D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
E. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
F. RCDD: Registered Communications Distribution Designer.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.
b. Minimum bending radius.
c. Maximum pulling tension.

B. Shop Drawings: Cable layout, showing routing to scale, with relationship between the cable and adjacent structural, electrical, and mechanical elements. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
C. Source quality-control reports.
D. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

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B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1.06 PROJECT CONDITIONS

A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

B. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.02 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.

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3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.03 LOW-VOLTAGE CONTROL CABLE

A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.04 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.
B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.
C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.05 FIRE ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Comtran Corporation.
2. Draka Cableteq USA.
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corp.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 18 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.

2.06 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. HellermannTyton.
3. Kroy LLC.
4. PANDUIT CORP.

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B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
C. Comply with requirements in Division 26 Section "Electrical Identification."

2.07 SOURCE QUALITY CONTROL
A. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
B. Factory test UTP cables according to TIA/EIA-568-B.2.
C. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.
D. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
E. Cable will be considered defective if it does not pass tests and inspections.
F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 INSTALLATION OF PATHWAYS
A. Comply with requirements in Division 26 Section "Raceways and Boxes" for installation of conduits and wireways.

3.02 INSTALLATION OF HANGERS AND SUPPORTS
A. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for installation of supports for pathways, conductors and cables.

3.03 WIRING METHOD
A. Install wiring in metal raceways and wireways. Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch. Control fire alarm and intrusion alarm transmission wiring shall not share conduit with other building wiring systems.
B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.04 INSTALLATION OF CONDUCTORS AND CABLES
A. Comply with NECA 1.
B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
C. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

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5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
9. All cables routed outside of building shall be protected from lightning by installing surge protection units at both ends of cables. Surge protectors shall be capable of handling maximum wattage on circuit.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.05 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

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B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes."

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.06 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Division 26 Section "Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.07 CONNECTIONS

A. Comply with requirements in Division 28 Section "Intrusion Detection" for connecting, terminating, and identifying wires and cables.

B. Comply with requirements in Division 28 Section "Video Surveillance" for connecting, terminating, and identifying wires and cables.

C. Comply with requirements in Division 28 Section "Digital Addressable Fire- Alarm System" for connecting, terminating, and identifying wires and cables.

3.08 FIRESTOPPING

A. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

B. Comply with TIA-569-B, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.09 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

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B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding."

3.10 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Perform tests and inspections.
C. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

D. Prepare test and inspection reports.

END OF SECTION

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SECTION 28 1600

INTRUSION DETECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Intrusion detection with communication links to perform monitoring, alarm, and control functions.

B. Related Sections:

1. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for cabling between master control units and field-mounted devices and control units.

1.02 DEFINITIONS

A. PIR: Passive infrared.

B. RFI: Radio-frequency interference.

C. UPS: Uninterruptible power supply.

D. Control Unit: System component that monitors inputs and controls outputs through various circuits.

E. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.

F. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.

G. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.

H. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.

I. Zone. A defined area within a protected premises. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

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1.03 SUBMITTALS REQUIRED

A. Product Data: Components for sensing, detecting, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.

1. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.
2. Master Control-Unit Console Layout: Show required artwork and device identification.
3. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
4. Sensor detection patterns and adjustment ranges.

C. Equipment and System Operation Description: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.

D. Samples for Verification: For each type of exposed finish required.

E. Qualification Data: For Installer intrusion detection systems integrator.

F. Field quality-control reports.

G. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Data for each type of product, including features and operating sequences, both automatic and manual.
2. Master control-unit hardware and software data.

H. Warranty: Sample of special warranty.

I. Other Information Submittals:

1. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications.
2. Examination reports documenting inspections of substrates, areas, and conditions.
3. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

1.04 QUALITY ASSURANCE

A. Installer Qualifications:

1. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

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B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.

D. Comply with NFPA 70.

1.05 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Altitude: Sea level to 1000 feet .
2. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.
3. Interior, Controlled Environment: System components, except master control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambients of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

1.07 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Intrusion Detection Devices: Furnish quantity equal to five percent of the number of units of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.01 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Description: Hard-wired, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.

B. Supervision: System components shall be continuously monitored for normal, alarm, supervisory, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

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1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.
2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.
3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or control unit.

C. System Control: Master control unit shall directly monitor intrusion detection units and connecting wiring.

D. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

E. Operator Commands:

1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
5. Protected Zone Test: Initiate operational test of a specific protected zone.
6. System Test: Initiate system-wide operational test.
7. Print reports.

F. Timed Control at Master Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.

G. Automatic Control of Related Systems: Alarm or supervisory signals from certain intrusion detection devices control the following functions in related systems:

1. Signal (output to surveillance camera system in order to alert camera) in vicinity of sensor signaling an alarm.

H. Response Time: Two seconds between actuation of any alarm and its indication at master control unit.

I. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

J. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

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2.02 SYSTEM COMPONENT REQUIREMENTS

A. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the following equipment:

1. Video surveillance systems.

B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient Voltage Suppression."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.

C. Intrusion Detection Units: Listed and labeled by a qualified testing agency for compliance with UL 639.

D. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.

E. Tamper Protection: Tamper switches on detection devices, control units, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Master control-unit alarm display shall identify tamper alarms and indicate locations.

F. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master control unit.

2.03 ENCLOSURES

A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.

B. Interior Electronics: NEMA 250, Type 12.

2.04 SECURE AND ACCESS DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ademco / Honeywell International Inc.; Honeywell Security.
2. Bosch Security Systems, Inc.
3. Edwards Signaling & Security Systems; part of GE Security.
4. Visonic Inc.

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B. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.

C. Key-Operated Switch: Change protected zone between secure and access conditions.

2.05 PIR SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ademco / Honeywell International Inc.; Honeywell Security.
2. Aleph America Corporation.
3. Bosch Security Systems, Inc.
4. Crow Electronic Engineering, Inc.
5. General Electric Company; GE Security, Inc.
6. Visonic Inc.

B. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.

C. Description: Sensors detect intrusion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.

1. Wall-Mounted Unit Maximum Detection Range: 125 percent of indicated distance for individual units and not less than 50 feet.
2. Ceiling-Mounted Unit Spot-Detection Pattern: Full 360-degree conical.
3. Ceiling-Mounted Unit Pattern Size: 84-inch diameter at floor level for units mounted 96 inches above floor; 18-foot diameter at floor level for units mounted 25 feet above floor.

D. Device Performance:

1. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps across two adjacent segments of detector's field of view.
2. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects an intruder. Locate test enabling switch under sensor housing cover.

2.06 MASTER CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements, provide Ademco (Honeywell) “Vista – 128BPT/Vista Turbo Series (Addressable)” or equals by one of the following:

1. Bosch Security Systems, Inc.
2. DAQ Electronics, Inc.
3. General Electric Company; GE Security, Inc.
4. Visonic Inc.

B. Description: Supervise sensors and their connecting communication links, status control (secure or access) of sensors activation of alarms, and supervisory signals and trouble signals, and other indicated functions.

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1. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
2. Include a real-time clock for time annotation of events on the event recorder and printer.
3. Addressable initiation devices that communicate device identity and status.
4. Control circuits for operation of mechanical equipment in response to an alarm.

C. Construction: Wall mounted enclosure modular, with separate and independent alarm and supervisory system modules. Alarm-initiating protected zone boards shall be plug-in cards. Arrangements that require removal of field wiring for module replacement are unacceptable.

D. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: LCD, three line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
3. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.
4. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.
5. Timing Unit: Solid state, programmable, 365 days.
6. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.
7. Alarm Indication: Audible signal sounds and a plain-language identification of the protected zone and addressable detector originating the alarm appears on LCD display at master control unit. Annunciator panel alarm light and audible tone identify protected zone signaling an alarm.
8. Alarm activation sounds a siren the intercom system throughout.

E. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of 25 percent.

F. Power Supply Circuits: Master control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a 25 percent increase in load.

G. UPS: UPS shall be sized to provide a minimum of six hours of master control-unit operation.

H. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch high. Identify, with permanent labels, individual components and modules within cabinets.

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I. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line. Comply with UL 1635. Contractor shall provide a minimum of one(1) year of monitoring service for automatic dialer.

2.07 AUDIBLE ALARM DEVICES

A. Interface intrusion alarm outlet such that audible alarm is sounded over the intercom system upon system activation.

B. Siren: 30-W speaker with siren driver, rated to produce a minimum sound output of 103 dB at 10 feet from master control unit.

1. Enclosure: Weather-resistant steel box with tamper switches on cover and on back of box.

2.08 SECURITY FASTENERS

A. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

1. Acument Global Technologies North America.
2. Safety Socket LLC.
3. Tamper-Pruf Screws.

C. Socket Flat Countersunk Head Fasteners:

1. Heat-treated alloy steel, ASTM F 835.
2. Stainless steel, ASTM F 879, Group 1 CW.

D. Socket Button Head Fasteners:

1. Heat-treated alloy steel, ASTM F 835.
2. Stainless steel, ASTM F 879, Group 1 CW.

E. Socket Head Cap Fasteners:

1. Heat-treated alloy steel, ASTM A 574.
2. Stainless steel, ASTM F 837, Group 1 CW.

F. Protective Coatings for Heat-Treated Alloy Steel:

1. Zinc chromate, ASTM F 1135, Grade 3 or Grade 4, for exterior applications and interior applications where indicated.
2. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

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PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of intrusion detection.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.

D. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.

1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.
2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.

E. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SYSTEM INSTALLATION

A. Comply with UL 681 and NFPA 731.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

3.03 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceways according to Division 26 Section "Raceways and Boxes." Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Wires and Cables:

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1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.
2. 120-V Power Wiring: Install according to Division 26 Section "Conductors and Cables" unless otherwise indicated.
3. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends shielded cable, according to Division 28 Section "Conductors and Cables for Electronic Safety and Security."
4. Data and Television Signal Transmission Cables: Install according to Division 28 Section "Conductors and Cables for Electronic Safety and Security."

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

E. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.

F. Identify components with engraved, laminated-plastic or metal nameplate for master control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Electrical Identification."

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements in Division 26 Section "Electrical Identification."

B. Install instructions frame in a location visible from master control unit.

3.05 GROUNDING

A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.

B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5 -ohm ground. Measure, record, and report ground resistance.

3.06 FIELD QUALITY CONTROL

A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

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1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.

B. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."

C. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

3.07 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal occupancy hours for this purpose. Visits for this purpose shall be in addition to any required by warranty.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the intrusion detection system. Comply with documentation provisions in NFPA 731, Ch. 4, "Documentation and User Training."

END OF SECTION

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SECTION 28 3111

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Magnetic door holders.
7. Remote annunciator.
8. Addressable interface device.
9. Digital alarm communicator transmitter.

1.02 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.03 SUBMITTALS REQUIRED

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified fire-alarm technician.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them.

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Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.

6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Qualification Data: For qualified Installer.

E. Field quality-control reports.

F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm technician.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of control panel, devices, or related equipment related to operation of system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two(2) years from date of Substantial Completion.

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1.06 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion.

1. Provide 30 days' notice to Owner to allow scheduling and access to system.

1.07 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents as noted on drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Notifier
2. Edwards/EST
3. Vigilant; a unit of UTC.
4. Fire Control Instruments, Inc.; a Honeywell company

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Verified automatic alarm operation of smoke detectors.
6. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Release fire and smoke doors held open by magnetic door holders.
5. Activate voice/alarm communication system.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Close smoke dampers in air ducts of designated air-conditioning duct systems.

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8. Activate emergency shutoffs for gas and fuel supplies.
9. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.03 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

2. Addressable initiation devices that communicate device identity and status.

a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.

C. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

D. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

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E. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.

1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.

    a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
    b. Programmable tone and message sequence selection.
    c. Standard digitally recorded messages for "Evacuation" and "All Clear."
    d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

F. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

G. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

H. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.04 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Retain first subparagraph below if physical protection other than a wire guard is required for manual stations or if protection from false alarms is required. Delete horn if not required.

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2.05 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
4. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Smoke detectors in duct work shall be photo electric type furnished and connected under Division 28, installation in duct work shall be accomplished under Division 23.
2. Power supply for detectors shall be 24 volts D.C. and supplied from fire alarm control panel.
3. Provide contacts to automatically shut down fan motors.
4. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
5. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

6. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
7. Each sensor shall have multiple levels of detection sensitivity.
8. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions were applied.
9. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.
10. Provide remote station having LED to indicate alarm condition and key switch to test and reset alarm relay at a readily accessible location for all duct detectors that are not readily accessible.

    a. In mechanical room mount remote station 6'-0" above finished floor.

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b. Where air handling unit or damper is above ceiling, mount remote station in wall below ceiling or in ceiling.

11. Detectors for air handling equipment rated over 2000 CFM, but less than 15,000 CFM shall be located in the supply duct.
12. Location of duct detectors shown is schematic in nature only. Verify exact location with unit and duct work placement.
13. Where duct detector is required to be on building exterior, provide weatherproof detector and 120 volt power as required.
14. Provide control modules at each detector. Modules shall be connected and programmed to close dampers and shunt down air handling units as required to meet building codes. Coordinate sequence of operation with mechanical.

2.06 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated. Fixed temperature of 200 deg F when required (i.e. kitchen).

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.07 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

C. Voice Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.

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2. Low-Range Units: Rated 1 to 2 W.
3. Mounting: Surface mounted and bidirectional.
4. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.08 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.

B. Material and Finish: Match door hardware.

2.09 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.

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2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. HVAC: Locate detectors not closer than 5 feet from air-supply diffuser or return-air opening.
4. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

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F. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

I. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

J. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

K. All fire alarm system conductors shall be installed in conduit. All conduit and back boxes shall be red.

3.02 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 8 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated air-conditioning duct systems.
2. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
3. Supervisory connections at valve supervisory switches..
4. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
5. Supervisory connections at fire-pump engine control panel.

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.04 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

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3.05 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Architect authorities having jurisdiction.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

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SECTION 311000
CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Clearing shall consist of the felling, trimming, cutting and disposal of trees and other vegetation designated for removal, including down timber, snags, brush and rubbish occurring within the area to be cleared. Grubbing shall consist of the removal and disposal of stumps, roots larger than 1.5 inches in diameter and matted roots.

PART 2 - EXECUTION

2.01 Trees, down timber, stumps, roots, brush and other vegetation in areas to be cleared shall be removed completely, except such trees and vegetation as may be indicated or directed to be left standing. Trees to be left standing within the cleared areas shall be trimmed of dead branches 1.5 inches or more in diameter.

2.02 Limbs and branches to be trimmed shall be neatly cut close to the bore of the tree or main branches. Cuts more than 1.5 inches in diameter shall be painted with commercial tree-wound paint.

2.03 All organic materials, masonry, concrete or metallic debris in the clearing and grubbing areas shall be excavated and removed to a depth of not less than 12 inches below grade where original grade is to remain level and two feet below finish grade, bottom of pavement base and bottom of footings.

2.04 Depressions made by grubbing shall be backfilled and compacted with fill material to meet the requirement for trenching and structural backfilling.

2.05 Machine grubbing shall not be done under trees left standing in the area covered by the branches, nor in any manner which might damage the trees or any new work.

2.06 Trees and vegetation to be left standing shall be protected from damage during clearing, grubbing and construction operations, by the erection of barriers.

2.07 Damages caused by the execution of clearing and grubbing shall be paid for by the Contractor.

2.08 Objects above or below grade interfering with construction to be removed as directed by the Engineer.

2.09 DISPOSAL OF MATERIALS

A. Cleared and grubbed materials to be disposed of to an approved off-site disposal area.

B. On site burning will not be allowed, without written permission of local authorities.

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SECTION 312000

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and backfilling for buildings and structures.
2. Drainage course for concrete slabs-on-grade.

B. Related Requirements:

1. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.

1.2 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."

B. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.

1.3 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. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

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E. 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 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.

F. Fill: Soil materials used to raise existing grades.

G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. 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. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.

H. 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.

I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D698 .

1.5 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

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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 Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service GEORGIA 811 before beginning earth-moving operations.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures indicated on Civil drawings are in place.

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: Soil Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487 free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: Less than 40.
2. Plasticity Index: Less than 20.
3. Standard Proctor (ASTM D 698) maximum dry density of 100pcf or greater.

C. Drainage Material: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

D. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve.

E. Sand: ASTM C33; fine aggregate.

F. Granular Aggregate Base: Granite/Gneiss Crusher Run or Crushed Concrete with Granite or Gneiss aggregate complying with GDOT Subsection 815.2.01 for Group II aggregates, except that the aggregate may be recycled concrete.

G. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

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

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3. Normal-Weight Aggregate: ASTM C33, 3/8-inch nominal maximum aggregate size.
4. Water: ASTM C94.

B. Produce conventional-weight, controlled low-strength material with 80-psi 140-psi compressive strength when tested according to ASTM C495.

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 earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide 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.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. 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.

D. 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.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

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.

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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.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. 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.

3.6 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 with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons 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. 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 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.

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3.7 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, pipe, or conduit as directed by Architect.

3.8 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. Do not store within drip line of remaining trees.

3.9 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, 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.

3.10 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 using satisfactory material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.11 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.

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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.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 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.

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 D698:

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 98 percent.

3.13 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.

B. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.14 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Construct drainage course of drainage material, granular aggregate base or sand.

B. Place drainage course on subgrades free of mud, frost, snow, or ice.

C. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course 6 inches or less in compacted thickness in a single layer.
2. 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.
3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D698.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

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1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. 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.

E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, 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 one test for every 1500 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.

F. 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 materials to depth required; recompact and retest until specified compaction is obtained.

3.16 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.

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3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END

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SECTION 312210
SITE GRADING

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

A. Reference Standards:

1. Standards of American Society for Testing and Materials:

ASTM-D-698 Moisture-Density Relations of Soils Using 5.5 lb. (2.5 KG) Hammer and 12 inch (304.8 mm) Drop

2. Methods of Sampling and Testing of American Association of State Highway and Transportation Officials (AASHTO), latest edition.

1.02 TESTING

A. All soil testing shall be performed by an Independent Testing Laboratory selected by the Engineer/Architect and paid for by the Owner.

1.03 EXCESS EXCAVATED MATERIALS

A. Excess excavated materials shall be wasted off site by the Contractor at no expense to Owner, or as directed by the Engineer, unless Owner and/or Engineer designate disposal area on-site.

1.04 BORROW MATERIAL

A. Any borrow material required to accomplish all levels, lines and grades indicated shall be furnished by the Contractor at no expense to the Owner.

B. Borrow material shall be obtained from borrow pits off site.

C. The Contractor shall pay for all soil analysis for borrow material.

1.05 EXCAVATED MATERIAL

A. All material to be excavated shall be classified as earth.

1.06 UNSUITABLE BEARING MATERIALS

A. Should unsuitable bearing materials be encountered at levels indicated and found to have insufficient bearing values the Engineer may order the excavation carried to lower depths.

B. Compensation for the removal and/or replacement of unsuitable materials shall be in accordance with the contract document.

C. Excavation of unsuitable bearing materials shall not proceed until the conditions have been observed by the Engineer and written approval has been given by the Owner.

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1.07 UNSTABLE SUITABLE BEARING MATERIALS

A. Should suitable bearing materials be encountered at levels indicated and found to be unstable by the Owner's material testing representative, for reasons such as but not limited to moisture content, the Contractor shall, at his discretion and cost, either make efforts to moisture condition the material through standard practices or replace the material with stable borrow material as necessary to achieve the desired compaction.

1.08 STRUCTURAL FILL

A. See Section 02300 "EARTHWORK" for Structural Fill specifications.

PART 2 - EXECUTION

2.01 TOP SOIL

A. Areas to be stripped shall first be scraped clean of all brush, weeds, grass, roots and other material.

B. Remove topsoil from areas to be graded and stockpile in locations where it will not interfere with structures, roads or utility operations.

C. Topsoil shall be free from subsoil, debris and stones larger than 2 inches in diameter. The stored topsoil shall be left in piles to be used for finished grading.

D. Stockpiles shall be protected from contamination by undesirable foreign matter and shall be graded to shed water.

2.02 EXCAVATION

A. Excavations shall be accomplished to bring surface to the levels, lines and grades as indicated.

B. Excavated material to be used for fill or backfill material shall be stockpiled on the site as directed by the Engineer. Stockpiles shall be graded to shed water.

2.03 FILLING

A. All fill material required to bring areas to the levels, lines and grades indicated shall be selected and approved materials from approved borrow areas.

B. Sub-grades on which fill material is to be placed shall be scarified to a depth of not less than 6 inches by plowing or discing. A layer of suitable fill material, approximately 3 inches in depth, shall be spread over the scarified surface and compacted.

C. Fill material shall be spread and compacted in successive uniform layers not exceeding 8 inches in depth (loose measure) until the total thickness of fill is completed.

2.04 COMPACTION

A. Compaction required for material fill shall be 95% of Standard Proctor (unless specified, otherwise, in Section 2300 Earthwork), maximum dry density as determined by the procedures of ASTM D-698. Fill areas shall be crowned and sloped to drainage ditches or as required to prevent ponding of surface water.

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B. Compaction by flooding of any material is not acceptable. In the event that any flooding takes place, the material and all adjacent softened material shall be removed and replaced with compacted fill at no cost to the Owner.

2.05 FINISH GRADE

A. Distribute topsoil evenly to levels, lines and grades shown.

B. Finish grade to be trimmed and raked true to line and grade to avoid surface ponding.

C. Remove stone two inches or greater in diameter and debris from soil.

D. Finish grade tolerance to +/- 0.05 foot for roadways and +/- 0.10 foot for other areas.

END.

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SECTION 312316
TRENCH EXCAVATION, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 SCOPE, STANDARDS & DEFINITIONS

A. Work under this section shall consist of furnishing all materials, equipment and labor for excavation, trenching and backfilling for utility systems. "Utility systems" shall include underground piping and appurtenances for water distribution systems, storm water drains, sewage collection systems, force mains, spray irrigation system and all other pipes and appurtenances shown on the drawings.

B. Applicable Standards and Reference

I. ASTM D2321 Soil Classification and Restrictions

a. Class IA = Manufactured crushed stone, shell, crushed slag or rock, open graded, clean, large voids, contains no fines, can allow sand migration to create excessive settling. Suitable as drainage blanket.
b. Class IB = Manufactured aggregate dense graded, clean, crushed stone with sand and gradation present. Closer void so little migration of sand, little fines. Minimal migration of sand. Suitable as drainage blanket.
c. Class II = Coarse grained soils and sand, graded gravel and sandy mix, minimal migration of silt or sand, use as drainage blanket and drains limited.
d. Class III = Coarse grain sand with fines, silty gravel, gravel-sand-silt mixture, clayey gravels, silty sand mixture. Not to be used in the presence of water.
e. Class IVA = Fine grain soils, inorganic, Inorganic silts and very fine sand, silty clayey fine sands, inorganic clay with minor plasticity, lean clay. Use only where no water exists and shallow fills.
f. Class IVB = Fine Grained soils inorganic, micaceous fine sand, silty soil, fat clay, clay with high plasticity. Use requires geotechnical evaluation.
g. Class V = Organic soils, clay and silt with organics. No permitted use other than top 6” outside roadways for soil amendment for grassing.

1.02 EXISTING UTILITIES

A. Before opening trenches, the Contractor shall examine all available records and explore for the location of all sub-surface pipes, valves or other structures and reference such locations on the surface.

B. In opening trenches, every effort shall be made not to interfere with these utilities’ structures. Expose existing piping by hand before excavating by machine. Excavate existing utilities sufficiently in advance of pipe laying to determine crossing arrangement. Slight deviations may be permitted in order to clear such structures. The Contractor shall be entirely responsible for the preservation of all underground or overhead utility lines and structures, such as gas, water, sewer lines, telephone conduit, power lines, etc., and shall replace, adjust or repair, without additional compensation, any such lines damaged or interfered with as a result of this construction.

C. Schedule work to keep roads and utilities in usable condition; coordinating all operation with the Owner to avoid inconvenience insofar as practicable.

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1.03 EXCAVATED MATERIAL

A. All material to be excavated shall be classified as earth.

1.04 BORROW MATERIAL

A. Any borrow material required to accomplish all levels, lines and grades indicated shall be furnished by the Contractor at no expense to the Owner.

B. Borrow material shall be obtained from borrow pits offsite, or areas designated onsite by Engineer.

C. The Contractor shall pay for all soils analysis of offsite borrow material.

1.05 TESTING

A. All soil testing shall be performed by an Independent Testing Laboratory selected by the Engineer/Architect and paid for by the Owner.

1.06 QUALITY ASSURANCE

A. All excavation within the rights of way of city streets and county, State or Federal roadways, shall be backfilled in accordance with the then prevailing requirements of the Georgia Department of Transportation, Highway Division.

B. Reference Standards: Methods of Sampling and Testing of American Association of State Highway and Transportation Officials (AASHTO).

PART 2 - EXECUTION

2.01 GENERAL EXCAVATION

A. The Contractor shall do all excavation of whatever substances encountered to depth shown on plans. Excavated materials not required for fill or backfill shall be removed from site as directed by the Engineer.

B. Contractor is to excavate to provide 3 foot minimum cover over utility.

C. Excavation for manholes and other accessories to have 12 inches minimum and 24 inch maximum clearance on all sides.

D. Excavation shall not be carried below the required level.

E. Where excavation is carried below grades indicated, the Contractor shall refill same to the proper grade with compacted earth or stone, or as directed by the Engineer.

F. Banks of trenches shall be vertical.

G. Width of trench shall be as shown on the plans. The bottom of trench for sewers and culverts shall be rounded so that an arc of the circumference equal to 0.6 of the outside diameter of the pipe rests on undisturbed soil.

H. Bell holes shall be excavated accurately to size by hand.

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2.02 UNSUITABLE BEARING MATERIALS

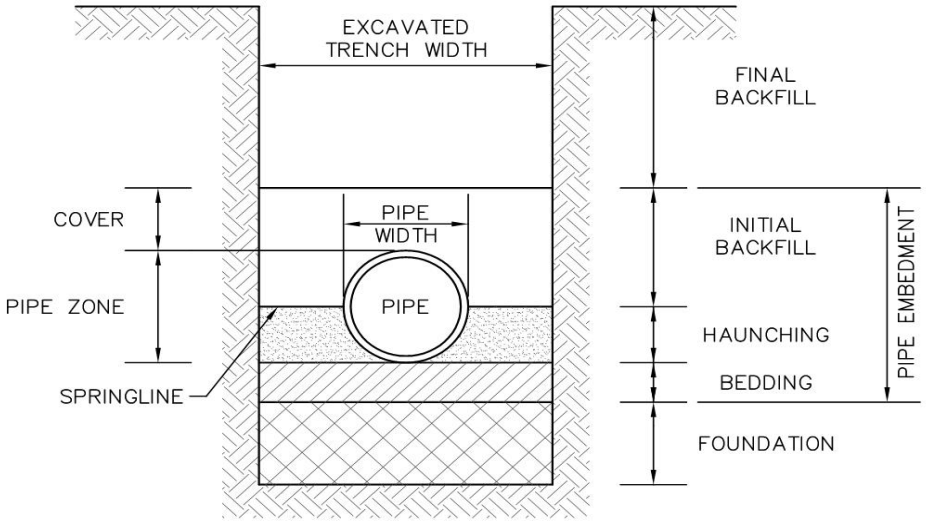
A. Should unsuitable bearing materials be encountered at levels indicated and found to have insufficient bearing values the Engineer may order the excavation carried to lower depth.

B. Compensation for the removal and/or replacement of unsuitable bearing materials shall be in accordance ASTM D2321 requirements.

C. Excavation of unsuitable bearing materials shall not proceed until the conditions have been observed by the Engineer and written approval is given by the Owner.

2.03 PIPE BEDDING

A. The following detail provides trench & pipe zone terminology.



PIPE BEDDING DETAIL
N.T.S.

B. The trench floor should be constructed to provide firm, stable, and uniform support for the full length of the pipe. This can be accomplished by bringing the entire trench floor level grade and then creating bell holes at each joint to permit proper joint assembly, alignment and support. Portions of the trench that are excavated below grade should be returned to grade and compacted as required to provide proper support. If native trench soil is not suitable for pipe bedding, the trench should be over excavated and refilled with suitable foundation material either local sandy material compacted to 90% Std. Proctor or #57 stone depending on the presence of water and, as approved by the engineer. Bedding material shall be Class IB or II as defined in ASTM D2321. Large rocks or hard material should not be contained in the bedding area (minimum of 4") below the pipe.

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C. The most important factor in assuring proper pipe-soil interaction is the haunching material and its density. This material provides the majority of the support that the pipe requires to function properly in regards to deflection and performance. The haunching material shall be placed and compacted under the pipe haunches as shown in the detail above. Proper control should be exercised to avoid deflecting the pipe from proper alignment. The same material that is used for bedding should be used for haunching and compacted to the same standards. Haunching material shall be Class IB or II as defined in ASTM D2321.

D. Initial backfill, as shown in the detail above, shall be accomplished with suitable, compactable material and compacted in 6" layers. Material shall meet the requirements of Class Ib, II or III as restricted in ASTM D2321.

E. Final Backfill will be accomplished by placing material in 12" lifts and compacting to a level determined by the final use of the area above the pipe. Final backfill in roadways shall require placement of suitable Class IA, IB, II and III backfill material, placed in 12" lifts and compacted to 100% standard proctor (ASTM Test D-698). Final Backfill outside of roadways shall be Class II, III or IVA and lightly compacted to avoid settling in the future. The top 6" of the final backfill, outside of roadways, shall be suitable for establishing a final grassed surface.

F. Material used in the "trench & pipe zone" shall be restricted as per the limitations and restrictions as outlined in ASTM D2321

2.04 BRACING AND SHORING

A. The Contractor shall do all bracing, sheeting and shoring necessary to perform and protect all excavations as required for safety.

B. Sheeting driven alongside the pipe should be cut off and left in place to an elevation 1.5 feet above the top of the pipe.

C. All other sheeting shall be removed as directed by the Engineer.

2.05 DEWATERING FOR EXCAVATION

A. The Contractor shall pump or remove any water accumulated in any excavated area and shall perform all work necessary to keep excavations clear of water while foundations, structures or any masonry are being constructed or while pipe is being laid.

B. No structure or pipe shall be laid in water, and water shall not be allowed to flow over or rise upon any concrete or masonry or piping until same has been inspected and the mortar or joint material has cured.

C. No extra compensation will be allowed for removal of water.

D. All water pumped or bailed from the trenches or other excavation shall be conveyed to a point of discharge where it will neither cause a hazard to the public health, nor damage to the public or private property, or to work completed or in progress.

2.06 BACKFILL

A. The soil at the sides of a pipe and above it is the backfill.

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B. Prior to backfilling any excavation, all piping and structures shall be observed by the Engineer.

C. After pipes have been tested and approved, backfilling shall be done with approved material free from large clods or stones.

D. Backfill shall be placed in uniform layers, four inches thick, on both sides of the pipe and thoroughly compacted with pneumatic or hand tampers. The backfill shall be brought up uniformly on both sides of the pipe and compacted to an elevation of one foot above the top of the pipe, after which the fill shall be placed in eight inch lifts. No rock will be allowed in the backfill within a distance of one foot from the pipe, and rock larger than six inches in the greatest dimension will not be permitted in any part of the trench or backfill.

1. Backfill shall be compacted to not less than 95% of the maximum dry weight per cubic foot as determined by AASHTO Method T-99 (Standard Proctor Test).

2. The top 18 inches of backfill under any paved area shall be compacted to 100% Standard Proctor.

3. Water settling will not be permitted in clay soils. It may be required at the option of the Engineer in sandy soils.

2.07 REPLACING PAVEMENTS

A. Subgrades shall be compacted with a mechanical tamper.

B. The minimum width of replaced concrete pavements shall be 4 feet at interiors and 6 feet at joints and constructed as shown on Standard Details. Avoid cutting pavements at joints; if unavoidable, reconstruct same as original joint. Depth shall be equal to the original thickness. Existing pavements edges shall be cut vertical.

C. Use high-early-strength cement if road is to be opened in less than 3 days.

D. The minimum width of replaced bituminous pavements shall be 3 feet with 8 inch concrete patch. The existing pavement shall be cut vertically and horizontally to a straight line. The 8 inch concrete patch shall be minimum 3,000 psi concrete containing black dye and shall be flush with the existing pavement.

END.

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SECTION 312510
EROSION CONTROL

PART 1 - GENERAL

1.01 The work specified in this Section consists of furnishing, installing and maintaining temporary erosion controls and temporary sedimentation controls.

1.02 DEFINITIONS

A. Temporary erosion controls shall include grassing, mulching, watering and reseeding on-site sloped surfaces, providing berms at the top of the slopes and providing interceptor ditches at the ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or minimized.

B. Temporary sedimentation controls shall include silt dams, traps, barriers and appurtenances at the toe slopes.

PART 2 - MATERIALS

2.01 Hay bales shall be clean, seed free cereal hay type, securely bound.

2.02 Netting shall be 1/2 inch, galvanized steel chicken wire mesh.

2.03 Filter stone shall be crushed stone conforming to the Department of Transportation - State of Georgia-Standard Specifications - Construction of Roads and Bridges – 2001 Edition (or latest version) - Table 800.01 H, Size Number 3.

2.04 Rolled Erosion Control Products:

A. Mulch Control Netting. A planar woven natural fiber or extruded geosynthetic mesh used as a temporary degradable rolled erosion product anchor loose fiber mulches
Max. Gradient = 5:1 (H:V) in slope application
C Factor = ≤0.10 @ 5:1 in slope application
Max Shear stress 0.25 lb/sf in channel application
Min. Tensile Strength ultra short (3 mo) and short (12 mo) term = 5 lbs/ft
Min Tensile Strength extended term ((24 mo) = 25 lbs/ft

B. Open Weave textile. A temporary degradable rolled erosion control product composed of processed natural or polymer yarns woven into a matrix, used to provide erosion control and facilitate vegetation establishment.
Max. Gradient = 3:1 (H:V) in slope application
C Factor = ≤0.15 @ 3:1 in slope application
Max Shear stress = 1.5 lb/sf in channel application
Min. Tensile Strength ultra short (3 mo) and short (12 mo) term = 50 lbs/ft
Min Tensile Strength extended term ((24 mo) = 100lbs/ft

C. Erosion Control Blanket. A temporary degradable rolled erosion control product composed of processed natural or polymer fibers mechanically, structurally or chemically bound together to form a continuous matrix to provide erosion control and facilitate vegetation establishment.

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Netless Rolled Erosion Control Blankets:
Max. Gradient = 4:1 (H:V) in slope application
C Factor = ≤0.10 @ 4:1 in slope application
Max Shear stress = 0.5 lb/sf in channel application
Min. Tensile Strength ultra short (3 mo) and short (12 mo) term = 5 lbs/ft

Single-net Erosion Control Blankets:
Max. Gradient = 3:1 (H:V) in slope application
C Factor = ≤0.15 @ 3:1 in slope application
Max Shear stress = 1.5 lb/sf in channel application
Min. Tensile Strength ultra short (3 mo) and short (12 mo) term = 50 lbs/ft
Min Tensile Strength extended term ((24 mo) = 100lbs/ft

Double-net Erosion Control Blankets:
Max. Gradient = 2:1 (H:V) in slope application
C Factor = ≤0.2 @ 2:1 in slope application
Max Shear stress = 1.75 lb/sf in channel application
Min. Tensile Strength ultra short (3 mo) and short (12 mo) term = 75 lbs/ft

D. Turf Reinforcement Mat. A rolled erosion control product composed of non-degradable synthetic fibers, filaments, nets, wire mesh,and/or other elements, processed into a permanent, three dimensional matrix of sufficient thickness. TRMs, which may be supplemented with degradable components, are designed to impart immediate erosion protection, enhance vegetation establishment and provide long term functionality by permanently reinforcing vegetation during and after maturation. These products are typically used in hydraulic applications such as high flow ditches, channels, steep slopes, stream banks, and shorelines, where erosive forces may exceed the limits of natural, unreinforced vegetation.

Slope Application max gradient = 0.5:1 (H:V)
Channel Application Max Shear Stress: 5A, B,C as defined in FHWA guidelines
5A = 6.0 lb/sf, 5B = 8.0 lb/sf, 5C = 10.0 lbs/sf
Min. Tensile Strength: 5A, B,C as defined in FHWA guidelines
5A = 125.0 lb/ft, 5B = 150.0 lb/ft, 5C = 175.0 lbs/ft
5A, B,C as defined in FHWA guidelines

PART 3 - EXECUTION

3.01 SEDIMENTATION CONTROL

A. Silt dams, traps, barriers, and appurtenances shall be installed and shall be maintained in-place for duration of construction.

B. Hay bales shall be staked with two (2) 1 x 4 wood stakes per bale driven eighteen (18) inches into the ground and finishing flush with the top of the bale.

1. Install two (2) stakes per bale with the long dimension of the stakes parallel to the long dimension of the bale.

2. Where bales are installed in multiple layers the bales shall be installed with vertical joints staggered and two (2) 1 x 4 wood stakes per bale driven through all layers, full from top of bale to eighteen inches into the ground.

C. Hay bales which have deteriorated shall be replaced with new materials.

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D. Erosion and sedimentation controls shall be maintained in a condition which will retain unfiltered water.

E. The Contractor shall construct the sedimentation ponds and control devices prior to clearing and grubbing the site to insure complete silt control. When the silt or the debris level is greater than 1 foot above the bottom of the pond, the Contractor shall remove the silt or debris to restore the proper elevation for the bottom of the pond.

F. The Contractor shall have all erosion and sedimentation control devices in service and operating properly prior to completion and final acceptance of the contract.

G. Two widths of silt fence are available, Type NS or S (36" height) and Type B (22" height). In order to determine which to use, the project duration, slope gradient, and slope length must be known (See Table 6-13.1 below). Approved silt fence fabrics are listed in the Georgia Department of Transportation list #36. The manufacturer shall have either an approved color mark yarn in the fabric or label the fabricated silt fence with both the manufacturer and fabric name every 100 feet.

TABLE 6-13.1

Land Slope	**Maximum Slope Length Behind Fence**
Percent	feet
<2	100
2 to 5	75
5 to 10	50
10 to 20	25
>20	15

All silt fence must meet the minimum standards set forth in Section 171- temporary Silt Fence, of the Department of Transportation, State of Georgia, Standard specification, current edition. See Table 6-13.5 for current Georgia DOT silt fence specifications.

3.02 EROSION CONTROL BALNKET INSTALLATION

A. Prepare a stable and firm soil surface free of rocks and debris. Apply soil amendments as necessary to prepare seedbed. Place fertilizer, water, seed in accordance with manufacture and specification recommendations. Unroll parallel to the primary direction of flow. Ensure that the product maintains intimate contact with the soil over the entire installation. Do not stretch or allow material to bridge over the surface. Staple/stake blanket to soil such that each staple/stake is flush with the underlying soil. Install anchor trenches, seams and terminal ends as specified.

B. The Upslope Trench, Seams and Terminal Ends may be secure by anchor trench, checks, slots or staples as outlined in Erosion Control technology Council (ECTC) standards for upslope security.

C. Staple installation shall be at a rate of 1.7 staples per square yard minimum. Sandy or silty soils may require more. Wet installations may require a more density securing.

D. If seaming method is used seams shall overlap at least 4" and staples must be placed at sufficient spacing to avoid separation.

E. Staples must be placed at 4"x 4" spacing on check slots and check seams.

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F. Consecutive rolls shall have overlaps of at least 6” and secured with staples every 1 foot.

3.03 RESPONSIBILITY

A. The Contractor shall be solely responsible for insuring that no silt or debris leaves the immediate construction site. Any silt or debris that does leave the immediate site shall be cleaned up and the area disturbed shall be returned to its natural state as directed by the Engineer at the Contractor’s expense.

B. The Contractor has the option to submit additional control measures in the form of shop drawings.

END.

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SECTION 321216
BASE AND PAVING

PART 1 - GENERAL

1.01 APPLICABLE STANDARDS

A. When used in this section, the term "Standard Specifications" shall mean the DEPARTMENT OF TRANSPORTATION, STATE OF GEORGIA STANDARD SPECIFICATIONS – CONSTRUCTION OF TRANSPORTATION SYSTEMS 2013 or later edition.

B. American Society for Testing and Materials (ASTM):

D-698 Test for, Moisture-Density Relations for soils

D-1557 Test for, Moisture-Density Relations for soils

PART 2 - PRODUCTS

2.01 MATERIALS

A. Base: The base shall conform to Section 310, Graded Aggregate Construction, of the Standard Specifications.

B. Prime: The prime coat shall be RC-70 and shall conform with Section 412, Bituminous Prime, of the Standard Specifications.

C. Tack Coat: The tack coat shall be RC-70 and shall conform with Section 413, Bituminous Tack Coat of the Standard Specifications.

D. Intermediate Course (Binder): The intermediate course shall be Superpave 12.5 mm or 19 mm Asphaltic Concrete and shall conform with Section 402, Hot Mix Asphaltic Concrete Construction of the Standard Specifications.

E. Crack Relief Interlayer: The crack relief interlayer shall be OGI Asphaltic Concrete and shall conform with Section 415, Asphaltic Concrete Open Graded Crack Relief Interlayer of the GDOT Standard Specifications and Special Provisions.

F. Surface Course - Asphalt Plant Mix: The surface course shall be either Superpave 9.5 mm or 12.5 mm Asphaltic Concrete and shall conform with Section 402, Hot Mix Asphaltic Concrete Construction, of the Standard Specifications.

G. Paint: Paint for pavement marking shall be in conformance with MUTCD publication and shall conform with Section 870, Paint, of the Standard Specifications.

H. Concrete Curb and Gutter: Shall conform to Section 441 -Concrete Curb, Gutter, Combination Curb and Gutter, Header, and Median of the Standard Specification.

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PART 3 - EXECUTION

3.01 COMPACTION

A. Sub-grade: The upper 24 inches of sub-grade soils in all cut areas and all fill areas that are to receive new pavements shall be scarified and re-compacted until a density equivalent to 95% standard Proctor maximum dry density in accordance with ASTM D698 has been obtained.

B. Base: All base shall have minimum compaction of 100% of the maximum density obtained by the test procedure present in ASTM D1557, Method D (Modified Proctor). The maximum permissible lift thickness shall be 6 inches (compacted). The contractor shall be required to perform all work necessary to meet the minimum compaction requirements.

C. Moisture Content: Compaction shall be performed only when the moisture content of the soil is within 4% of the optimum moisture content at the time of compaction as determined by ASTM D698. Soils are to be dried prior to compaction by discing and aeration. An Independent Testing Laboratory shall determine if soils are within the optimum moisture content. The contractor shall be required to perform all work necessary to meet the minimum compaction requirements.

3.02 CONSTRUCTION

A. Preparation of Sub-grade: Prior to placing of base and pavements, the construction of all utility lines (water, sewer, power, gas, etc.) which are to be placed under the pavements shall have been completed.

B. Base: The base course shall be constructed in accordance with Section 310 of the Georgia Department of Transportation Standard Specifications to the compacted thickness specified.

C. Prime: The prime coat shall be applied at a rate of 0.25 gallons per square yard and in accordance with Section 413 of the Georgia Department of Transportation Standard Specifications.

D. Tack Coat: The tack coat shall be applied at a rate of 0.10 gallons per square yard and in accordance with Section 413 of the Georgia Department of Transportation Standard Specifications.

E. Crack Relief Interlayer: The crack relief interlayer shall be constructed in accordance with GDOT Section 415 of the Georgia Department of Transportation Standard Specifications and Special Provisions.

F. Intermediate and Surface Course - Asphalt Plant Mix: The intermediate and surface courses shall be constructed in accordance with Section 402 of the Georgia Department of Transportation Standard Specifications to the thickness indicated. All thicknesses are compacted.

G. Painting Stripe: Pavement striping is required and shall be in accordance with Georgia Department of Transportation MUTCD publication.

H. Existing pavement which has pavement markings damaged by this construction shall be repainted.

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I. Concrete Curb and Gutter: Shall be constructed in accordance with Section 441 of the Georgia Department of Transportation Standard Specification.

3.03 TESTING

A. Compaction testing shall be performed by an approved testing laboratory. Sub-grade and base compaction testing shall be performed at a spacing not to exceed 500' staggered for the entire length of the street. On streets shorter than 1,000' the testing spacing shall reduce to 300' and in no case will be less than three tests per street, equally spaced. The Design Engineer and Construction Inspector shall be provided copies of the test information prior to placement of base material or final pavement.

B. Prior to the installation of any base material a test roll must be performed along the entire roadway length, both sides of the road. The test roll shall be performed utilizing an 18 C.Y. tandem axle dump truck loaded with at least 12 C.Y. of soil or gravel. The same test roll will be required on the base material prior to beginning pavement installation. The Design Engineer and Construction Inspector shall be present during the test roll.

C. Prior to beginning the installation of any asphalt pavement, the base material shall be tested to determine thickness and graded cross section of the base material. The contractor shall provide labor and equipment to auger through the base material to check to insure the thickness specified in the plans and specifications has been achieved. In addition, the cross slope of the base and the depth below the gutter face shall be checked, utilizing a string line, to insure proper crown and asphalt depth at the edge has been achieved with the base grading. If the depth of base material is insufficient the base present will be removed, the subgrade lowered and adequate base material will be replaced to achieve the required thickness. If the cross slope or edge depth is determined to be less than the specified thickness, the area will be rejected until the area is re-graded to the slope and the thickness specified on the approved plan.

D. The Owner at his option may check the thickness of the asphalt pavement and base material after the installation is complete. If the Owner finds the materials to be less than specified the contractor/developer shall take necessary measures to meet the requirements of the approved plans and specifications.

E. Prior to any striping being performed, the contractor shall prepare a striping plan for approval by the Construction Inspector.

3.04 EXISTING PAVEMENT RESTORATION

A. Pavement damaged due to construction shall be patched or replaced in accordance Section 400 of the Georgia Department of Transportation Standards and Specifications.

B. Pavement damaged by new utility trenches shall be restored in accordance with the pavement removal and replacement details. Any pavement removed must be disposed of by the contractor at a permitted site.

C. Existing inlets, manholes, or valve boxes shall be adjusted by the Contractor to the new grade lines and elevations. All adjustments to structures in areas proposed for pavement shall be accomplished prior to construction of the surface course.

D. Adjustment to grade of existing frames shall include raising or lowering the upper portion of the structure, including any necessary sleeve extensions, adjustable manhole rings, gaskets, mortar, masonry or other approved material, to bring the frame to the required grade.

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3.05 STRIPING OF PAVEMENT MARKINGS

A. Striping shall consist of furnishing and applying traffic markings with paint or thermoplastic in accordance with the contract drawings and specifications, and the requirements of the current Federal and State "Manual On Uniform Traffic Control Devices."

B. Thermoplastic Plastic Stripe shall consist of solid or broken (skip) lines, words and/or symbols of the type, color and the location shown on the plans. It is the intent of these specifications that short lines which are defined to be crosswalks, stop bars, arrow symbols and crosshatching shall be extruded. All other lines, unless otherwise specified, shall be sprayed.

C. Cleaning: All pavement areas to be striped shall be thoroughly cleaned. Cleaning may be accomplished by the use of hand brooms, rotary brooms, air blasts, scrapers or other approved methods which leave the paving surface thoroughly clean and undamaged. Particular care shall be taken to remove all vegetation and road film from the area to be striped.

D. Warranty: The Contractor shall transfer to the Governing Authority the warranty on Thermoplastic materials issued by the Manufacturer.

END.

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SECTION 321217
PAVEMENT REMOVAL AND REPLACEMENT

PART 1 - GENERAL

1.01 DEFINITION

A. When used in this section, the term "Standard Specifications" shall mean the DEPARTMENT OF TRANSPORTATION, STATE OF GEORGIA STANDARD SPECIFICATIONS FOR CONSTRUCTION OF ROADS AND BRIDGES, 2001 Edition or later edition, unless amended herein.

1.02 DESCRIPTION

A. Related Work Specified Elsewhere:

1. Trench Excavation, Backfill and Compaction-Section 02221.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Base: Granular material to meet the following gradation:

SIEVE SIZE	PERCENT PASSING BY WEIGHT
1-1/2"	100
3/4"	60-100
10	30-55
60	8-35
200	5-20

B. Concrete: 3000 psi compressive strength

C. Prime Coat: RC-70 Georgia DOT Specifications

D. Asphalt Surface Course: The surface course shall be either Superpave 9.5 mm or 12.5 mm Asphaltic Concrete and shall conform with Section 402, Hot Mix Asphaltic Concrete Construction, of the Standard Specifications.

PART 3 - EXECUTION

3.01 CONCRETE PAVEMENT REPLACEMENT (DRIVEWAYS)

A. Existing pavement shall be removed to a minimum of 12 inches on either side of the trench.

B. Following trench backfilling and compaction, the depth of concrete pavement replaced shall match the existing pavement or shall be a minimum of 6 inches thick, whichever is greater.

C. Joints and finish of the concrete slab shall match existing pavement.

D. Pavement replacement for each driveway shall be accomplished with one pour. Deviation must be approved by the Engineer.

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E. All joints shall have waterproof sealer to avoid water intrusion and deterioration of the patch.

3.02 CONCRETE PAVEMENT REPLACEMENT (ROADWAY)

A. Existing pavement shall be removed to a minimum of 12 inches on either side of the trench.

B. A minimum 8 inch concrete slab containing black dye in the top 2 inches (minimum) shall be placed extending 12 inches on either side of the trench and on undisturbed soil.

C. Depth of concrete pavement replaced shall match the existing pavement or shall be a minimum of 8 inches thick, whichever is greater.

D. Joints and finish of the slab shall match existing pavement. Joints shall have expansion material between old and new paving.

E. All slabs shall be installed in one pour unless directed otherwise by the Engineer. If construction joints are required, measures must be taken to avoid deterioration of the patch later by water intrusion.

3.03 ASPHALT PAVEMENT REPLACEMENT

A. Existing pavement shall be removed to a minimum of 12 inches on either side of the trench.

B. Granular base material shall be placed to a minimum depth of 8 inches and compacted to 95% maximum dry density following trench backfilling and compaction.

C. If so directed by the Engineer the base shall be a 6 inch concrete slab extending 12" on either side of the trench and on undisturbed soils, then a 2 inch asphalt surface course shall be placed after a prime coat is applied to the concrete slab at the rate of 0.25 gallons per square foot to bring the paving to grade.

3.04 MAINTENANCE OF SURFACE

A. Pavement damage due to settlement of backfill: Repair for period of bond.

B. Depressions more than 6 inches deep in aggregate surfaced areas: Fill to grade for period of bond.

3.05 TESTING

A. Certified laboratory reports shall be required to ensure the subgrade has been compacted to 95% and the base compacted to 100% standard proctor.

END.

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SECTION 321313
CONCRETE PAVING

PART 1 - GENERAL

1.01 QUALITY STANDARDS

A. Any procedure and material operation specified by reference to the following publications shall comply with the requirements of the current specification or standard:

1. American Society for Testing Materials (ASTM):

A185 Welded Steel Wire Fabric for Concrete Reinforcement.

A615 Deformed Billet-Steel Bars for Concrete Reinforcement.

C31 Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field.

C33 Specification for Concrete Aggregate.

C39 Compressive Strength of Molded Concrete Cylinders.

C94 Specification for Ready-Mixed Concrete.

C143 Slump of Portland Cement Concrete.

C150 Portland Cement.

C172 Sampling Fresh Concrete.

C192 Making and Curing Concrete Test Specimens in the Laboratory.

D1751 Preformed Expansion Joint Fillers for Concrete Paving.

2. American Concrete Institute:

ACI 301 Specification for Structural Concrete for Buildings.

ACI 305 Recommended Practice for Hot Weather Concreting.

ACI 318 Building Code Requirements for Reinforced Concrete.

1.02 QUALITY CONTROL

A. The Contractor shall submit to the Engineer, for review a design mix for each class of concrete listed under CLASSES OF CONCRETE, prior to placing any concrete.

B. Verification tests of design mixes and aggregates are required by the Engineer. Verification test specimens shall be made in accordance with ASTM C39 by an Independent Test Laboratory. Compressive strength shown by verification tests shall be at least fifteen percent in excess of the strengths listed under CLASSES OF CONCRETE. The Independent Testing Laboratory shall

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report the test results to the Engineer, in writing and shall note any failure to meet the specification.

C. Verification tests of design mixes made not more than one year prior to the date of submittal will be acceptable provided they were made from materials identical to those to be used in the project.

D. Mill Test: Conducted in accordance with ASTM A615 recommendations on each 15 tons or less reinforcing shipped to the job. Two (2) copies of test to be sent to the Engineer.

E. Inspection and Testing of Concrete:

1. The cost of slump tests and sampling, molding, storing, materials, transporting concrete test specimens shall be paid by the Contractor. The laboratory or inspection agency shall be selected by the Owner. Costs of all laboratory testing services required because of failure to meet the requirements of these specifications shall be paid by the Contractor.

2. One set of four (4) acceptance cylinders shall be prepared for each day's placing of each strength of concrete and if more than 50 cubic yards of concrete is placed in any day, there shall be an additional set of cylinders prepared for each 50 cubic yards placed or for any fraction thereof. One cylinder shall be broken at seven days and two at twenty-eight days, with one cylinder held in reserve.

3. Responsibilities in Inspection:

a. Laboratory's Duties

1. The reception and marking of specimens in the laboratory, laboratory curing, preparation for breaking and testing of cylinders shall be the responsibility of the laboratory and shall be performed by qualified laboratory personnel, observing all requirements of applicable ASTM Standards. Compression test specimens shall be tested in accordance with ASTM C39.

2. Prior to the commencement of concrete work, the laboratory shall provide initial instruction in the performance of sampling and testing duties for an employee designated by the Contractor and shall provide him with copies of all ASTM Standards pertinent to his duties.

b. Contractor's Duties:

1. The Contractor shall deliver to the laboratory all materials to be used in required testing. He shall supply wheelbarrows, shovels, mixing boards, shaded work space and similar equipment required for molding test cylinders. He shall provide stable, insulated storage boxes, equipped with thermostatically controlled heat, for storage of cylinders in the first 24 hours after molding.

2. He shall designate an employee, who alone shall perform all operations of sampling concrete, molding test specimens, protecting test specimens for the first 24 hours after molding, and packing and shipping of test specimens. The employee shall make a record of a slump test in connection with each truckload of concrete. The designated employee shall receive initial instruction in the performance of his sampling and testing duties from a representative of the testing laboratory and shall have available copies of all ASTM Standards pertinent to his duties. Sampling shall conform to ASTM C172. Slump tests shall conform

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to ASTM C143. Compression test specimens shall be made and cured in accordance with ASTM C31.

3. Each set of test cylinders shipped to the laboratory shall be accompanied by a report giving information as to location in the structure of concrete sampled, time and date of sampling, air temperature, slump, class designated nominal strength, air content if applicable, temperature of concrete, truck number, and time batched. Each report shall be signed by the employee making the test and by the Contractor or his representative, certifying that the test specimens have been made by the one designated, fully instructed employee and have been made in accordance with applicable standard specifications.

4. Should any concrete fail to meet the specified strength, have a slump in excess of that required by the design mix for each class of concrete listed under CLASSES OF CONCRETE, or result in voids, honeycombs or otherwise fail to meet the requirements, the Engineer may order the concrete removed, further tests made, or other remedial measures taken, all at the Contractor's expense.

1.03 SHOP DRAWINGS

A. After making his check the Contractor shall submit to the Engineer one (1) blue line copy of each of placing plans, bending details and bar lists covering all reinforcing steel.

B. Full information for checking and for proper installation without reference to other drawings shall be included. At splices the amount of lap shall be shown. Location and arrangement of accessories shall be clearly shown. Elevations shall be drawn for all reinforced masonry and reinforced concrete walls to a scale no smaller than 1/4 inch = 1 foot.

C. Work shall not proceed before the Contractor has received shop drawings approved by the Engineer. The Contractor shall be responsible for the conformation of all typical and special reinforcing steel details.

D. Engineer's review is for conformance to the design concept and contract documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the project plans and specifications, nor departures therefrom. The Contractor remains responsible for details and accuracy, for selecting fabrication processes, for techniques of assembly, and for performing his work in a safe manner.

E. Proposed construction joint shall be clearly indicated on shop drawings and subject to approval of the Engineer.

1.04 INSPECTION

A. The Contractor shall give the Engineer 24 hours advance notice before starting to place concrete in any portion of the structure to permit observation. An authorization of the Engineer shall be secured before concrete is placed. Any concrete placed in violation to this provision shall be replaced by new concrete if required by the Engineer.

B. Prior to notification of the Engineer, the Superintendent shall personally inspect the work and verify that it is ready for observation.

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C. At the time of observation, all reinforcing in the area where concrete is to be poured shall be in place, tied and ready for the placement of concrete. All anchors, sleeves, inserts, etc., shall be securely held in position.

1.05 STORAGE

A. Reinforcing steel delivered to the job and not immediately placed in forms shall be placed in racks or other supports at least eighteen (18) inches above ground.

PART 2 - MATERIALS

2.01 CEMENT

A. Portland cement shall conform to ASTM C150, Type I.

2.02 AGGREGATES

A. Aggregates for standard weight concrete shall conform to ASTM C33, maximum size: 3/4 inch.

2.03 WATER

A. Mixing water shall be potable.

2.04 REINFORCING STEEL

A. Reinforcing bars shall be American manufactured conforming to the requirements of ASTM A615 "Deformed Billet Steel Bars for Concrete Reinforcement", Grade 60.

B. Welded wire-fabric or cold-drawn wire for concrete reinforcement shall be of American manufacture and shall conform to the requirements of the ASTM A185 "Welded Steel Fabric for Concrete Reinforcement".

C. Accessories shall conform to the requirements of C.R.S.I. Manual.

2.05 READY MIXED STRUCTURAL CONCRETE:

A. Ready mix concrete shall be mixed and delivered in accordance with these specifications and requirements set forth in ASTM C94. In addition, these following conditions must be met:

1. Concrete shall be normal weight with an ultimate compressive strength at 28 days, and slump as follows:

2. Air entrained concrete shall be used for all structural concrete with the air content not less than 3 percent and no more than 5 percent.

B. Classes of Concrete:

Class A f'c = 3000 psi, Slump 4 inches +/- 1 inch
Class AA f'c = 4000 psi, Slump 3 inches +/- 1 inch
Class B f'c = 5000 psi, Slump 5 inches +/- 1 inch

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2.06 EXPANSION JOINT MATERIAL

A. Expansion joint material at slabs on grade shall be premolded asphalt saturated cellulose fiber or mineral strips conforming to ASTM D1751.

2.07 WALL TIES

A. Ties shall be made with break back ends or other means of removing the tie end to a depth of at least 1 inch from the concrete surface after the forms are removed.

2.08 LIQUID FORM SEALER

A. Form sealer shall be a standard product compatible with the finish required for exposed concrete and shall contain no paraffin oil or mineral oil.

PART 3 – EXECUTION

3.01 FORMWORK

A. Forms shall conform to the shapes, lines and dimensions of the members as indicated, and shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be braced or tied together so as to maintain position and shape.

B. Formwork shall be observed by the Engineer before pouring concrete. Before placing the reinforcement, surfaces of wood forms in contact with the concrete, unless lined, shall receive a thorough coating of form sealer. The Engineer shall have the right to reject any forms that do not appear to him to be sufficient as to alignment and of producing the required finished surface. Should misalignment of forms or screed, excessive deflection of forms or displacement of reinforcing occur during concrete placing, corrective measures shall be immediately made to the extent, if necessary, that placing operations shall be stopped and concrete removed from within forms. The surfaces to required dimensions and cross section. Exposed lines and surfaces shall not vary from dimensions shown on plans by more than 1/4 inch in twenty feet.

C. Forms may be constructed of wood or metal. Earth forms for footings may be permitted if local conditions are favorable, and approved by the Engineer. Form work for exposed concrete shall be form grade plywood.

D. Studs, waler, and ties shall be so spaced that the load of wet concrete will not stress ties beyond the printed working load recommended by the manufacturer not cause spans of form material to deflect from a true surface.

E. The Contractor shall maintain a continuous check upon formwork during the placing of concrete. An instrument check shall be periodically made or "Tattle Tail" rods or other devices shall be used to detect any settlement in forms.

F. Conduits in Concrete: Conduits shall not displace reinforcing steel from its intended position, nor impair the strength of the structure.

G. The Contractor shall assume all responsibility for removal of formwork. Elevated concrete slabs shall attain 70% of the specified ultimate strength before removing the forms. After removing forms, slabs shall be reshored at mid-span and at all points under shores supporting forms for the work above. No floor shall be loaded in excess of the live load for which designed unless adequate shores are place beneath members supporting the concrete of load.

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3.02 PLACING REINFORCING STEEL

A. Reinforcement shall be shop fabricated, accurately positioned and secured with not less than 16 gauge annealed wire or suitable clips.
B. No bars, partially embedded in concrete shall be field bent, unless noted otherwise.

C. Reinforcing bars shall be accurately placed and secured in position by approved chairs, spacers or ties to maintain the position of the reinforcing steel prior to and during placing of concrete.

D. Reinforcing steel support chairs and bolsters for use in concrete to be exposed shall have galvanized steel leg.

E. No splices shall be made, except as shown on approved Shop Drawings or approved in writing by the Engineer.

F. The placement of reinforcement shall be observed by the Engineer before pouring of concrete. Should there by any delay in the work, reinforcement previously placed shall be reinspected and cleaned if necessary before concrete placement is resumed.

G. Metal reinforcement shall be protected by concrete cover. Where not otherwise shown, the thickness of concrete over the reinforcement shall be as follows:

Footings	3" clear sides and bottom
Slabs	3/4" clear, top and bottom
Beams	2" clear, all around
Walls	2" clear, both faces
Columns & Piers	2" clear

H. All splicing or reinforcement not shown shall be approved by the Engineer. Splices shall not be made at a point of maximum stress and shall provide sufficient lap to transfer the stress between bars by bond. Hook and bending details, column tie arrangements, etc., shall be as shown by the S.R.A.I. Manual or the ACI Detail Engineering Manual.

I. Wire mesh reinforcing shall be placed one inch from top of concrete slabs on ground. Lap all joints 12 inches and extend mesh to within 1 inch of sides and ends of slabs.

3.03 CONCRETE MIXING AND PLACING

A. Ready-mix concrete shall conform to ASTM C94. Not more than one hour shall elapse between the time mixing water is added to the batch and the concrete is poured.

No water shall be added on the job.

B. No concrete shall be placed until all embedded items and reinforcing have been placed in the forms and observed by the Engineer. At least 24 hour notice shall be given the Engineer of an impending pour, so that he may observe the work, prior to placing.

C. Concrete shall be conveyed from the mixer to the place of final deposit by methods that will prevent segregation or loss of materials.

D. Concrete shall be deposited in its final position to avoid segregations and separation due to rehandling or flowing. The placing shall be carried on at such a rate that concrete is at all times

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plastic and flows readily into the spaces between bars. When placing is once started, it shall be carried on as a continuous operation, until placement of that section is completed.

E. Concrete shall be worked into and around bars and embedded items with spades, rods, trowels and vibrators, so as to produce a solid homogeneous mass, free of voids, pockets or honeycombs.

F. Construction joints shall be installed and located as indicated. Where a joint occurs, the surface of the concrete shall be thoroughly cleaned and all laitance removed and shall be left rough or mechanically roughened, thoroughly wetted and slushed with a coat of neat cement grout immediately before placement of new concrete.

G. All embedded items, including anchor bolts and dowels, shall be in place, preset and held in position, before any concrete is placed.

H. No concreting shall be performed when ambient temperatures are below 40°F or if the temperature is predicted by the local U.S.Weather Bureau will fall below 40°F within 24 hours after the time of installation.

I. No concrete shall be installed against frozen ground. All foundation cavities and slab areas that have frozen shall be thoroughly clean of all loose earth prior to pouring concrete.

J. All newly poured concrete shall be protected from freezing or near freezing weather during the cure period.

K. Hot weather precautions shall be taken whenever the maximum air temperature exceeds 80°F during the day. Hot weather concreting shall be performed in accordance with ACI 305.

3.04 EXPANSION/CONTROL JOINT INSTALLATION

A. Expansion joints shall be placed a maximum of 20 ft. intervals and at all intersections with steps, curbs other walks or abutting structures. Joints shall extend from the surface to the subgrade at right angles to the sidewalk. All expansion joints shall be filled with semi-rigid epoxy, specifically manufactured for the sealing of expansion joints in concrete slab construction, to create a water tight slab.

B. Expansion joint filler shall be 1/2 inch thick and as wide as the full width and depth of the sidewalk. All control joints shall be filled with semi-rigid epoxy, specifically manufactured for the sealing of control joints in concrete slab construction, to create a water tight slab.

C. Control joints (tooled or saw-cut) shall be placed at no less than 12 and no more than 15 ft. intervals, in a square grid, throughout the full length and width of the concrete slab. All control joints shall be filled with semi-rigid epoxy, specifically manufactured for the sealing of control joints in concrete slab construction, to create a water tight slab.

3.05 ANCHORAGE

A. Slots, inserts, and connections elements for anchoring items to concrete shall be built into forms before placing concrete.

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3.06 SLABS ON GRADE

A. Concrete shall be compacted, screeded to grade and prepared for the specified finish. Slabs shall be placed in panels in alternate checkerboard pattern or in alternate lanes divided into panels. Each panel shall be approximately square terminated by slab joints.

B. Contraction joints shall be true to line 1/8 inch wide, and of depth equal to approximately 1/4 of the slab thickness. Joints shall be sawed or formed.

3.07 CURING

A. Provisions shall be made for maintaining concrete in a moist condition for at least 10 days after the placement of the concrete, or by one of the following methods:

1. Spraying with water or ponding.

2. Using moisture retaining covers.

3. Concrete curing compound, W.R. Meadows CS-309 or Guardian Chemical Co., Master Builders or Triple-Cure by Cobra Chemicals.

B. The spraying water shall be applied on unformed surfaces within one hour after the forms are stripped and the spraying shall be continuous. The moisture retaining cover shall be applied on unformed surfaces immediately after the concrete is finished. If there is any delay, the concrete shall be kept moist until the application is made. If the surfaces are formed, the forms shall be removed and the concrete sprayed lightly with water before the cover is applied.

C. When concrete surfaces are to receive applied finishes of materials, all curing compounds shall be checked for compatibility with other material to be applied to the concrete surfaces before application.

3.08 CONCRETE FINISHES

A. All poured joints, voids, honeycombs and other imperfections shall be patched within the same working day that forms are removed.

B. Troweled Finish:

1. Troweled finish shall be applied to the surface of all floors unless ceramic tile, quarry tile or pavers are called for on finish schedule.

2. Floor slabs shall be screened to an even surface by the use of straight-edge and screeding strips accurately set to the proper grade. The concrete shall be floated with a wood float in a manner which will compact it and produce a surface free from depressions or inequalities of any kind. Floors shall be level with a tolerance of 1/8 inch in 10 feet except where drains are indicated. After the concrete has hardened sufficiently to prevent fine materials from working to the top and has been allowed to stand until all water sheen has disappeared, it shall be steel troweled. Final troweling shall be done after the concrete is hard enough that no mortar accumulates on the trowel and a ringing sound is produced as the trowel is drawn over the surface. The drying of the surface moisture before troweling shall proceed naturally and shall not be hastened by the dusting on of dry sand or cement.

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C. Non-slip Finish: All exterior platforms and step treads shall be made non-slippery by application at not less than 1/4 lb. per sq. ft. of aluminum oxide or emery aggregate graded from particles retained on a #50 mesh screen to particles passing an 1/8 inch screen placed during the finishing process. Abrasive aggregate shall be sprinkled by hand as soon as the freshly placed cement will support the weight of workmen and floated into the surface.

D. Unfinished Slabs: Depressed slab areas to receive ceramic quarry tile or pavers shall be finished to remove all laitance and to leave a slightly roughened, surface to insure bond. The surface of the slab shall not vary in any direction more than 1/8 inch when tested with a ten foot straight edge. The straight edge shall be lapped one half its length as the test is being made.

3.09 CONCRETE FLOOR HARDENER

A. All concrete floor slabs shall be cured with concrete floor hardener, "Clear Bond", as manufactured by Guardian Chemical, "Triple-Cure: by Cobra Chemicals, or "Sealtight Cs-309 by W.R. Meadows. The floor hardener shall be applied in strict accordance with the manufacturer's recommendations.

B. Walks shall be tooled, full 1 inch deep into separate slabs as indicated. Surface edges of each slab shall be rounded to approximately 1/4 inch radius.

C. Final finish shall be a medium or light broom finish and all tool marks completely removed.

END.

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SECTION 321825

TRACK SURFACING

PART 1- GENERAL

1.01 Scope:

A. The synthetic surfacing contractor shall furnish all labor, materials, equipment, supervision and services necessary for the proper completion of the specified Synthetic Track Surfacing and related work indicated on the drawings and specified herein.

The synthetic surfacing contractor shall refer to the drawings for the required locations of synthetic track surfacing to be installed. The track and all events shall receive surfacing. All quantities and dimensions shall be field verified by the synthetic surfacing contractor.

1.02 Specific Scope of Work

A. Install an IAAF approved impermeable polyurethane synthetic track system consisting of SBR Rubber and a single-component polyurethane binder and a poured-in-place, two-component U.V. stabilized elastomeric polyurethane wearing layer with an encapsulated textured finish.

B. Layout and paint all track lines and event markings as required and specified by current IAAF and NCAA rules.

1.03 Coordination

A. The synthetic surfacing contractor shall coordinate the work specified with an authorized and appointed representative of the owner so as to perform the work during a period and in a manner acceptable to the owner.

PART 2 - CODES AND STANDARDS

2.01 Applicable Publications Codes and standards follow the current guidelines set forth by the International Amateur Athletic Association (IAAF), the National Collegiate Athletic Federation (NCAA) along with the current material testing guidelines as published by the American Society of Testing and Materials (ASTM).

2.02 Performance Standards

The new synthetic track surfacing system shall exhibit the following minimum performance standards as required by IAAF.

A. Thickness Average – (13-14 mm)
B. Force Reduction 35 to 50%
C. Modified Vertical Deformation 0.6 to 1.25 mm
D. Friction TRRL Skid Resistance >47
E. Tensile Strength 0.5 Mpa
F. Elongation at break >40%

PART 3PART 3 - QUALITY ASSURANCE

3.01 Contractor and Manufacturer Qualifications

A. The contractor and the manufacturer must be the same.

B. The synthetic surfacing contractor must have a minimum of ten (10) years of experience in the installation of full-depth poured-in-place two-component elastomeric polyurethane synthetic track surfacing.

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C. The synthetic surfacing contractor must have installed a minimum of six outdoor track facilities in the last two years using the exact Synthetic Track Surfacing System as specified herein.
D. The polyurethane manufacturer must have a minimum of 10 years of uninterrupted experience with compound two-part polyurethane for athletic surfaces.
E. The supervisor for the installation must have installed a minimum of 20 two component polyurethane tracks in the last 3 years.

3.02 Submittals

The following submittals must be received with bid submittal:

A. Standard printed specifications of the synthetic track surfacing system to be installed on this project.
B. An affidavit attesting that the synthetic track surfacing material to be installed meets the requirements defined by the manufacturer's currently published specifications and any modifications outlined in those technical specifications.
C. A synthetic track surfacing sample, 6 x 6 in size, of the same synthetic track surfacing system to be installed on this project.
D. An installation list of outdoor track facilities installed within the last two years, using the exact synthetic track surfacing system specified herein.

PART 4- MATERIALS

4.01 Approved Manufacturers:

A. Beynon Sports Surfaces BSS-300 Encapsulated (Basis of Design)
B. Spurtan (Advanced Polymer Technology)
C. Fisher Tracks

4.02 Elastomeric Polyurethane

A. Two-component U.V. stabilized elastomeric polyurethane compounded from polyol and isocyanate components, based on one hundred percent Methylene Diphenyl Isocyanate (MDI). No Toluene Diisocyanate Isocyanate (TDI) will be allowed.
B. The elastomeric polyurethane color will be selected by Architect.

4.03 EPDM Granulate

A. The EPDM granulates shall be 1 to 3mm in size and peroxide cured.
B. The EPDM granulates and the U.V. stabilized elastomeric polyurethane shall be color matched.

4.04 Rubber Granulate of the base course

A. Styrene Butadiene Rubber (SBR) processed ground to a graded size of 1-3mm.
B. A maximum of 82%, by weight of the paved-in-place base layer, of SBR will be allowed.

4.05 Single Component Polyurethane Binder

A. A minimum of 18%, by weight of the paved-in-place base layer.

4.06 Seal Coat

A. The granular SBR and binder layer shall be sealed with a thickened two-component polyurethane.

4.07 Aliphatic Coating

A. Pigmented polyurethane aliphatic coating
B. Aliphatic Coating shall be read in color matching the UV stabilized elastomeric polyurethane.
C. No clear or two component coatings will be allowed.

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4.08 Line Marking Paint

A. Manufacturers recommended pigmented line point.

PART 5 - INSTALLATION

5.01 Subbase

A. The Synthetic Track Surfacing System shall be laid on an approved subbase. The General Contractor shall provide compaction test results of 95% or greater for the installed subbase and asphalt surface.

B. For NCAA and IAAF certification the following criteria must be followed. The track surface, i.e. asphalt substrate, shall not vary from planned cross slope by more than + 1 %, with a maximum lateral slope outside to inside of .01% and a maximum slope of 1% in any running direction. The finished asphalt shall not vary under a 10' straight edge more than 1/8”.

C. It should be the responsibility of the asphalt-paving contractor to flood the surface immediately after the asphalt is capable of handling traffic, but within 24 hours. If, after 20 minutes of drying time, there are birdbaths evident, it shall be the responsibility of the architect, in conjunction with the surfacing contractor to determine the method of correction. No cold tar patching, skin patching or sand mix patching will be acceptable.

D. Any oil spills (hydraulic, diesel, motor oil, etc.) must be completely removed, either by chipping out or removing and replacing with new, keyed in asphalt. The minimum depth of any asphalt replacement shall be one inch. The curing time for the asphalt base is 28 days. It shall be the responsibility of the surfacing contractor to determine if the asphalt substrate has cured sufficiently prior to the application of polyurethane surfacing system.

E. It shall be the responsibility of the general contractor to determine if the asphalt substrate meets all design specifications, i.e. cross slopes, planarity and specific project criteria. After all the above conditions are met, the synthetic surfacing contractor must, in writing, accept the planarity of the asphalt receiving base, before work can commence.

5.02 Thickness

A. The thickness of the Synthetic Track Surfacing System shall be 13mm.

5.03 Equipment

A. The Synthetic Track Surfacing System components shall be processed and installed by specially designed machinery and equipment. A mechanically operated paver with variable regulated speed and thermostatically controlled screed shall be used in the installation of the base mat. The wearing course shall be installed using automatic electronic portioning, which provides continuous mixing and feeding for an accurate, quality controlled installation.

B. No Hand Mixing is allowed.

5.04 Installation

A. Base Course

The SBR granules and polyurethane shall be mixed together on site to regulate the ratio/quantity of SBR, not to exceed 82% in the base mat portion of the system. The single component polyurethane binder shall be mixed with the SBR rubber so that a minimum of 20%, by weight, exists in the final mixture. This mixture is then mechanically installed using the paver

B. Seal Coat

The granular layer shall be sealed with a thickened two-component polyurethane, squeegee applied to ensure a non-permeable base layer.

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C. Wearing Course
The .5 to 1.5 mm EPDM granules shall be integrated into poured-in-place U.V. stabilized elastomeric polyurethane to achieve the full depth of the 5 mm wearing course. The resilient textured finish shall be a dense matrix of exposed EPDM granules. The homogeneous wearing course shall be applied in situ with the base course.

5.05 Site Conditions

A. Installation shall not take place if adjacent or concurrent construction generates excessive dust, abrasives or any other by-product that, in the opinion of the installer, would be harmful to the track material, until completion of such works.

B. Apply Synthetic Track Surfacing in dry weather when pavement and atmospheric temperatures are fifty (50) degrees Fahrenheit or above, and are anticipated to remain above fifty (50) degrees Fahrenheit for twenty-four (24) hours after completing application.

C. The maximum temperature cannot exceed 105 degrees at any point during a 24 – hour period.

D. Rain cannot be falling. If there is a threat of rain, work shall cease until dry conditions can be reestablished on the track pavement. Work is to proceed only when adequate curing can be guaranteed by the manufacturer.

PART 6 - LINE STRIPPING AND EVENT MARKINGS

6.01 Layout

A. Line stripping and event markings shall be laid out in accordance with current IAAF and NCAA rules.

6.02 Certification

A. Upon completion the owner shall be supplied with all necessary computations and drawings as well as a letter of certification attesting to the accuracy of the markings.

PART 7 - GUARANTEE

7.01 Synthetic track surfacing system shall be fully guaranteed against faulty workmanship and material failure for a period of five (5) years from the date of acceptance.

7.02 Synthetic surfacing material found to be defective as a result of faulty workmanship and/or material failure shall be replaced or repaired at no charge, upon written notification within the guarantee period.

END.

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SECTION 323113

CHAIN LINK FENCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Poly Vinyl Chloride (PVC) coated chain link fabric with PVC color coated galvanized steel framework and accessories for commercial or industrial applications.

1.02 RELATED SECTIONS

01300 Submittals
01400 Quality Control
03300 Cast-In-Place Concrete

1.03 REFERENCES

A. ASTM A36 Standard Specification for Carbon Structural Steel
B. ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-dip Galvanized
C. Coatings
D. ASTM B221 Standard Specification for Aluminum and Aluminum Alloy Bars, Rods, Wire Profiles and Tubes
E. ASTM F552 Standard Terminology Relating to Chain Link Fencing
F. ASTM F567 Standard Practice for Installation of Chain Link Fence
G. ASTM F626 Standard Specification for Fence Fittings
H. ASTM F668 Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain Link Fence Fabric
I. ASTM F900 Standard Specification for Industrial and Commercial Swing Gates
J. ASTM F934 Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials
K. ASTM F1043 Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework
L. ASTM F1083 Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
M. ASTM F1184 Standard Specification for Industrial and Commercial Horizontal Slide Gates
N. ASTM F1664 Standard Specification for Polyvinyl Chloride (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used With Chain Link Fence
O. WLG2445 Chain Link Fence Manufacturers Institute, Chain Link Fence Wind Load Guide for the Selection of Line Posts and Line Post Spacing

1.04 SUBMITTALS

A. Changes in specifications may not be made after the bid date.
B. Shop drawings: Layout of fences and gates with dimensions, details, and finishes of components, accessories, and post foundations.
C. Product data: Manufacturer's catalog cuts indicating material compliance and specified options.
D. Samples: If requested, samples of materials (e.g., fabric, wires, color, and accessories).

1.05 QUALITY ASSURANCE

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A. Manufacturer: Company having manufacturing facilities in the United States with 5 years experience specializing in manufacturing of chain link fence products.
B. Fence contractor: Contractor having 5 years experience installing similar projects in accordance with ASTM F567.
C. Tolerances: ASTM current specification and tolerances apply and supersede any conflicting tolerance.
D. Substitutions: Alternate chain link products may be acceptable by the architect as equal if approved in writing three (3) days prior to bidding provided that the items submitted meet the specifications contained in this document.
E. Single source: To ensure system integrity obtain the chain link system, framework, fabric, fittings, gates and accessories from a single source.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Approved Manufacturer: Master Halco, Inc.
One City Blvd. West, Suite 900
Orange, CA 92868
Phone (800) 229-5615 Fax (714) 385-0107
www.masterhalco.com, E-mail: spec@fenceonline.com

B. Jamieson Manufacturing Co.
(800) 527-6464
info@jamiesonfence.com www.jamiesonfence.com

C. Stephens Pipe and Steel, Inc.
www.spsfence.com

2.02 CHAIN LINK FENCE FABRIC

A. Poly Vinyl Chloride (PVC) color coated steel chain link fabric per ASTM F668 Class 2b
B. Size and Height: Chain link fabric 2 in. mesh, 9 gauge core (measured prior to coating).
C. Selvage of fabric knuckled at top and knuckled at bottom.
D. Color of chain link fabric per ASTM F934: Black

2.03 PVC COLOR COATED STEEL FENCE FRAMEWORK: Black

A. Steel pipe Type I: ASTM F1043 Group IA, ASTM F1083 standard weight schedule 40 hot-dip galvanized pipe having a zinc coating of 1.8 oz/ft² (550 g/m²) on the outside and 1.8 oz/ft² (550 g/m²) on the inside surface. Exterior of pipe to have F1043 PVC thermally fused color coating, minimum thickness 10 mils (0.254 mm).Regular Grade: Minimum steel yield strength of 30,000 psi (205 MPa)
B. Pipe End and Corner Post: 4 OD
C. Pipe Line Post: $2^{3}/_{8}$"; 3.65 lbs/ft.
D. Pipe Rail and Braces, 1.660 in. OD (42.2 mm) 2.27 lbs/ft

2.04 FITTINGS

A. All fittings to be PVC thermally fused color coated having a minimum thickness of 0.006" (0.152 mm) per ASTM F626. PVC color to match fabric and framework. Moveable parts, nuts and bolts to be field coated with PVC liquid touch up after installation.
B. Post caps: ASTM F626 galvanized pressed steel, malleable iron, or aluminum alloy weather tight closure cap for tubular posts. Provide one cap for each post. "C" shaped line post without top rail do not require post caps. When top rail is specified provide line post loop tops to secure top rail.

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C. Rail ends: Galvanized pressed steel per ASTM F626, for connection of rails to post using a brace band.
D. Top rail sleeves: 7" (178 mm) galvanized steel sleeve per ASTM F626.
E. Wire ties: 9 gauge (0.148") (3.76 mm) galvanized steel wire for attachment of fabric to line posts and rails. Pre-formed hog ring ties to be 9 gauge (0.148") (3.76 mm) galvanized steel or aluminum for attachment of fabric to tension wire. Tie wire and hog rings PVC coated and in compliance with ASTM F626. Color to match fabric color.
F. Brace and tension (stretcher bar) bands: ASTM F626 galvanized 12 gauge (0.105") (2.67mm) pressed steel by 3/4" (19mm) formed to a minimum 300 degree profile curvature for post attachment. Secure bands using minimum 5/16" (7.94 mm) galvanized carriage bolt and nut.
G. Tension (stretcher) galvanized steel bars: One piece lengths equal to 2 inches (50 mm) less than full height of fabric with a minimum cross-section of 3/16" x 3/4" (4.76 mm x 19 mm) per ASTM F626. Provide tension (stretcher) bars where chain link fabric is secured to the terminal post.
H. Truss rod assembly: Galvanized steel minimum 5/16" (7.9mm) diameter truss rod with pressed steel tightener, in accordance with ASTM F626
I. Carriage bolts and nuts: Galvanized of commercial quality

2.05 TENSION WIRE

A. Tension wire: Poly Vinyl Chloride (PVC) coated metallic coated steel tension wire per ASTM F 1664 [7 gauge steel core wire, 0.177" (4.50 mm)] PVC coating class and color to match chain link fabric.

2.06 CHAIN LINK SWING GATES

A. Swing gates (Refer to Drawings for Sizes). Fabricate chain link swing gates in accordance with ASTM F900. Gate frame to be of welded construction. Weld areas to be protected with zinc-rich paint per ASTM A780 then over coated with liquid PVC to match frame. The gate frame members are to be spaced no greater than 8' 0" (2.44 m) apart horizontally or vertically. Exterior members to be 1.900" (48.3 mm) OD pipe, interior members when required shall be 1.660" (42.2 mm) OD pipe. PVC coated pipe to be per section 2.03. Chain link fabric to match specification of fence system. Fabric to be stretched tightly and secured to vertical outer frame members using tension bar and tension bands spaced 12" (304.8 mm) on center and tied to the horizontal and interior members 12" (304.8 mm) on center using 9 gauge galvanized steel ties per section 2.04.
B. Hinges, hot dip galvanized pressed steel or malleable iron, structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing 180° (3.14 rad)
C. Latch: Galvanized forked type capable of retaining gate in closed position and have provision for padlock. Latch shall permit operation from either side of gate.
D. Double gates: Provide galvanized drop rod with center gate stop pipe or receiver to secure inactive leaf in the closed position. Provide galvanized pressed steel locking latch, requiring one padlock for locking both gate leaves, accessible from either side.
E. Keeper to secure open leafs: Provide galvanized gate hold back keeper for each gate leaf over 5' (1524 mm) wide. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.
F. Latch, hinges, moveable parts may be field coated with liquid PVC.
G. Gate posts: PVC color coated, Grade 1 pipe ASTM F1083 per section 2.03, OD [select gate post from table below]

Gate fabric height up to and including 6 ft. (1.2m)

Gate leaf width	Outside Diameter

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Up to 4 ft.	(1.2 m)	2.375 in. (60.3 mm)
Over 4 ft. to 10 ft.	(1.2 to 3.05 m)	2.875 in. (73.0 mm)
Over 10 ft. to 18 ft.	(3.05 to 5.5 m)	4.000 in. (101.6 mm)

2.07 CHAIN LINK INTERNAL TRACK ALUMINUM CANTILEVER SLIDE GATE

A. Aluminum cantilever slide gate single leaf (Refer to Drawings for Sizes) shall be of the internal roller design per ASTM F1184 Type II Class 2. Cantilever slide gate to be constructed of PVC color coated ASTM B221 aluminum members welded and designed for maximum structural integrity. Vertical external and internal members minimum 2" (50 mm) square spaced maximum 8' 0" (2.44 m) on center. Gates having fabric greater than 8' 0" (2.44 m) in height require a horizontal member. The top horizontal member shall be a one-piece precision extruded structural member having an integral enclosed track. Bottom horizontal member to be minimum 2" x 4" (50 x 100 mm). Adjustable diagonal X trusses shall be installed in each gate panel to transfer the alternating forces as the gate slides. The gate opening portion shall be filled with chain link fabric stretched taut and secured to the frame members. Chain link fabric shall match the fence system specification. The overall gate structure shall be a minimum of 40% larger than the gate opening to support the cantilevered portion of the gate in the closed position with minimum deflection per ASTM F1184. The minimum 40% back frame does not require the installation of chain link fabric for those gates not to be electrically operated. Single leaf cantilever design for openings larger than 30' 0" (9.15 m) up to 40' 0" (12.2 m) shall be fabricated by welding together two horizontal top structural/track members creating a dual track system. Single track gates up to 30' 0" (9.15 m) opening require two support posts and two internal truck assemblies. Dual track gates over 30' 0" (9.15 m) up to 40' 0" (12.2 m) require two sets of dual posts and four internal truck assemblies.

B. Internal truck assemblies shall be capable of swiveling to accommodate gate movement and ensure full contact of the four support wheels and two guide wheels to the internal track surface. The galvanized steel truck assembly post bracket, truck assembly vertical support axle as well as the support wheels shall be designed to handle static and dynamic forces required to support and operate the gate. The truck assembly, support axle and internal wheels shall be comprised of stainless steel or galvanized steel components.

C. Galvanized steel bottom guide roller brackets containing two 3" (75 mm) rubber wheels shall be supplied to keep the bottom of the gate plumb and in proper alignment.

D. Single gates shall be supplied with a galvanized steel latch mechanism capable of securing the gate with a padlock accessible from either side. Double gates to have galvanized drop rod to hold inactive leaf and a latch mechanism capable of securing the gate with a padlock accessible from either side. Provide drop rod stop pipe or receiver to engage center drop rod.

E. Cantilever gate posts shall be 4.00" (101.6 mm) OD PVC coated Grade 1 pipe ASTM F1083 per section 2.03. Single leaf cantilevers up to 30' 0" (9.15 m) require three 4.00" (101.6 mm) OD posts, dual track single leaf cantilevers over 30' 0" (9.15 m) up to 40' 0" (12.2 m) require two sets of pre fabricated dual 4.00" (101.6 mm) OD support posts and a 4.00" OD (101.6 mm) latch post. The gate is supported in the center of the dual posts.

2.08 POST SETTING MATERIALS

A. Concrete: Minimum 28 day compressive strength of 3,000 psi (20 MPa).

PART 3 - EXECUTION

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3.01 SITE EXAMINATION

A. Ensure property lines and legal boundaries of work are clearly established.
B. Survey of fence location to be provided by general contractor.
C. Verify areas to receive fencing are completed to final grade.

3.02 CHAIN LINK FRAMEWORK INSTALLATION

A. Install chain link fence system in accordance with ASTM F567 and manufacturer's instructions.
B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30° or more.
C. Space line posts uniformly 8' (2438 mm) on center.
D. Concrete set posts: Dig holes in firm, undisturbed or compacted soil. Holes shall have diameter 4 times greater than outside dimension of post, and depths approximately 6" (152 mm) deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36" (914 mm) below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post and slope to direct water away from posts.
E. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.
F. Bracing: Install horizontal brace and truss assembly at mid-height or above for fences 6' (1829 mm) and over at each fabric connection to the terminal post. The diagonal truss rod is installed at the point where the brace rail is attached to the terminal post and diagonally down to the bottom of the adjacent line post. Place the truss rod in tension by adjusting the turnbuckle.
G. Tension wire: Install tension wires so that it will be located 4" (101.6 m) up from bottom the fabric. If top rail is not specified, install the tension wire so that it will be located 4" (101.6 mm) down from the top of the fabric. Stretch and Install tension wire before installing the chain link fabric and attach it to each post using wire ties.
H. Top rail: Install in lengths of 21' (6.400 m). Connect ends with sleeves forming a rigid connection, allow for expansion and contraction.
I. Center Rails: Install mid rails between line posts and attach to post using rail end or line rail clamps.
J. Bottom Rails: Install bottom rails between posts and attach to post using rail end or line rail clamps.
K. Touch up any nicks or scratches of the PVC color coating with liquid PVC paint.

3.03 CHAIN LINK FABRIC INSTALLATION

A. Fabric: Install fabric on security side, pull fabric taut; thread the tension bar through fabric and attach to terminal posts with tension bands spaced maximum of 15" (381 mm) on center and attach so that fabric remains in tension after pulling force is released. Install fabric so that it is 2" (50 mm) +/- 1" (25 mm) above finish grade.
B. Secure fabric using wire ties to line posts at 15" (381 mm) on center and to rails and braces 24" (610 mm) on center, and to the tension wire using hog rings 24" (610 mm) on center. Tie wire shall be secured to the fabric by wrapping it two 360 degree turns around the chain link wire pickets. Cut off any excess wire and bend back so as not to protrude so as to avoid injury if a pedestrian may come in contact with the fence.

3.04 CHAIN LINK GATE INSTALLATION

A. Swing gates: Installation of swing gates and gate posts shall be per ASTM F567. Direction of swing shall be as shown on drawings. Gates shall be hung plumb in the closed position with minimal space from grade to bottom of gate leaf. Double gate drop bar receiver shall be set in a minimum concrete footing 6" (152 mm) diameter

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by 24” (610 mm) deep. Gate leaf holdbacks shall be installed on all double gates and all gate leafs greater than 5’ (1524 mm) in width.

B. Horizontal slide gates: Install cantilever and overhead horizontal slide gates and gate posts in accordance with ASTM F567. Horizontal sliding gates shall be plumb in the closed position with minimal ground clearance and slide with an initial force of 40 lbs. (18.14 kg). Double gate drop bar receiver shall be set in a minimum concrete footing 6” (152 mm) diameter by 24” (610 mm) deep. Install top and bottom safety roller covers and adjacent safety guide posts on ASTM F1184 Type II Class 2 external roller cantilever.

3.05 ACCESSORIES

A. Per 2.10A

3.06 SITE CLEAN UP

A. Clean up area adjacent to fence line from debris and unused material created by fence installation.

END OF SECTION

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SECTION 328400

PLANTING IRRIGATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Furnish all labor, materials, supervision, and equipment necessary for a complete automatic irrigation system.

B. Irrigation infrastructure shall accommodate future zone areas including controller, pipe, zone control valves, temporary plugs, etc.

C. Section Includes:

1. Piping.
2. Reduce pressure area backflow protector
3. Manual valves.
4. Pressure-reducing valves.
5. Automatic control valves.
6. Automatic drain valves.
7. Transition fittings.
8. Dielectric fittings.
9. Miscellaneous piping specialties.
10. Sprinklers.
11. Quick couplers.
12. Controllers.
13. Boxes for automatic control valves.
14. Wiring

1.03 QUALIFICATIONS

A. Irrigation System Installer shall have not less than 5 years experience installing sports field irrigation systems and general landscaping irrigation systems.

B. Installation shall meet applicable codes / guidelines including National Electrical Code and The Irrigation Association Guidelines.

1.04 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

C. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote control, signaling power-limited circuits.

1.05 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

B. Delegated Design: Design 110 percent coverage irrigation system for areas indicated on drawings including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated and installation by a qualified installer.

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1. No land records are available for soil conditions. Reference the project soils map and available geotechnical report for general soil information.
2. Design and install all irrigation piping, valves, controllers and other devices necessary for a complete irrigation system. Make minor adjustments necessary to avoid obstructions such as signs and light standards.
    a) Irrigation contractor shall determine point of connection to the existing well based on the new irrigation system requirements and the capabilities of the new/existing well pump motor.
    b) Contractor shall zone new irrigation system to maximum pump capacity and to prevent cycling of the well pump motor.

C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:
1. Irrigation Main Piping: 150 psig.
2. Circuit Piping (lateral and sub-main pipe): 100 psig.

1.06 SUBMITTALS

A. Shop Drawings, Equipment Product Data and Samples: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
1. Prior to purchasing materials, submit product information on all sprinkler heads, automatic valves, quick coupling valves, controller, and pipe to be used on the project.
2. Prior to trenching, Contractor shall submit proposed trenching equipment to Architect for approval.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Submittal shall include hydraulic calculations including design assumptions, hydraulic gradelines, sprinkler sizing, etc.

D. Coordination Drawings: Irrigation systems, drawn to scale, on which components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and light standards. Drawings to be signed and sealed by the qualified professional engineer responsible for their preparation.

E. Qualification Data: Recent project experience of similar or larger size.

F. Zoning Chart: Show each irrigation zone and its control valve, including control valves to serve future zones.

G. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

H. Field quality-control reports.

I. Operation and Maintenance Data: For sprinklers controllers and automatic control valves to include in operation and maintenance manuals.

J. Record Drawings and Instructions
1. Upon completion of installation, Contractor shall produce as-built drawings in AutoCAD 2009 format and furnish one set of reproducible and one set of printed record drawings showing all sprinkler heads, valves, drains, and pipelines to scale with dimensions. These drawings shall have dimensions from easily located stationary points (cross measured) as they relate to all valves, mainlines, and wire. Clearly note all approved substitutions of size, material, etc. Complete, concise instruction sheets and parts lists covering all operating equipment and

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weathering techniques shall be bound into folders and furnished to the Owner in three (3) copies. Submission of this information is a requirement for final acceptance.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers that include at least two of the following: Certified irrigation designer qualified by The Irrigation Association, Professional Class member of the American Society of Irrigation Consultants, Professional Technical Class member of the American Society of Irrigation Consultants.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Conference: Before any work is started a conference shall be held between the Contractor, Architect and Owner concerning the work under this contract.

D. The Contractor shall maintain continuously a competent superintendent, satisfactory to the Owner, on the work during progress with authority to act or him in all matter pertaining to the work.

E. It is the Irrigation Contractor's responsibility to coordinate and cooperate with the other Contractors to enable work to proceed rapidly and efficiently.

F. The Contractor shall confine his operations to the area to be improved and to the areas allotted him by the Architect and General Contractor for material and equipment.

G. Contractor shall take all necessary to protect the existing site conditions and vegetation.

1.08 CODES AND ORDINANCES

A. All materials and operations shall conform to all applicable codes and ordinances. It is the Contractor's responsibility to investigate and follow all regulations.

1.09 PERMITS AND FEES

A. The Contractor shall obtain, at his expense, all required permits and shall pay all required fees. Any penalties imposed due to failure to obtain any permit or pay any fee shall be the responsibility of the Contractor.

1.10 WARRANTY AND GUARANTEE

A. The Contractor shall furnish a certificate of warranty registration and a written guarantee of work and materials for a one-year period from the date of the final acceptance of the Irrigation System by the Owner and the Architect.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.12 PROJECT CONDITIONS

A. The Contractor shall examine the site, plans and specifications (i.e. system requirements).

B. It shall be the Contractor's responsibility to report in writing to the Architect any deviations between drawings, specification, and actual site conditions. Failure to do so prior to the installing of equipment shall be done at the Contractor's expense.

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C. Adjustment of the sprinkler heads and automatic equipment will be done by the Contractor, upon completion of installation, to provide optimum performance.
D. After completion, testing, and acceptance of the system, the Contractor shall verbally instruct the Owner's personnel in the operation and maintenance of the system. All written instruction shall be included in the bound maintenance package as stated in Paragraph 1.3 – Submittals.
E. Electrical work shall include coordination of materials and labor with electrical sub-contractor.

1.13 EXTRA MATERIALS
A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Spray Sprinklers: Equal to 5 percent of amount installed for each type and size indicated, but no fewer than 5 units.

PART 2 - PRODUCTS

2.03 PIPES, TUBES, AND FITTINGS
A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
B. PVC Pipe (under 3"): ASTM D 1785, PVC 1120 compound, Schedules 40 and 80 with NSF .
1. PVC Socket Fittings (under 2 ½"): ASTM D 2466, Schedule 40 and 80.
2. PVC Threaded Fittings (under 2 ½"): ASTM D 2464, Schedule 80.
3. PVC Socket Unions (under 2 ½"): Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.

2.04 PIPING JOINING MATERIALS
A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick unless otherwise indicated; full-face or ring type unless otherwise indicated.
B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
C. Brazing Filler Metals: AWS A5.8/A5.8M, BCUP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
E. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended piping system manufacturer unless otherwise indicated.

2.05 MANUAL VALVES
A. Curb Valve (main lines):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a) Amcast Industrial Corporation; Lee Brass Company.
b) Ford Meter Box Company, Inc. (The).
c) Jones, James Company.
d) McDonald, A. Y. Mfg. Co.
e) Mueller Co.; Water Products Division.
f) Red Hed Manufacturing & Supply.
2. Description:

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a) Standard: AWWA C800.
b) NPS 1 and Smaller Pressure Rating: 100-psig minimum.
c) NPS 1-1/4 to NPS 2 Pressure Rating: 150 psig.
d) Body Material: Brass or bronze with ball or ground-key plug.
e) End Connections: Matching piping.
f) Stem: With wide-tee head.

B. Curb-Valve Casing (main line):
1. Standard: Similar to AWWA M44 for cast-iron valve casings.
2. Top Section: Telescoping, of length required for depth of burial of curb valve.
3. Barrel: Approximately 3-inch diameter.
4. Plug: With lettering "WATER."
5. Bottom Section: With base of size to fit over valve.
6. Base Support: Concrete collar.

C. Shutoff Rods for Curb-Valve Casings: Furnish two steel, tee-handle shutoff rod(s) with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve for Project.

D. Plastic Ball Valves (Sch. 80 -1/2" to 3"): Install (1) ball valve in lateral line at each automatic control valve within same underground box.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a) American Valve, Inc.
b) Asahi/America, Inc.
c) Colonial Engineering, Inc.
d) Fischer, George Inc.
e) Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f) IPEX Inc.
g) Jomar International, LTD.
h) KBI (King Bros. Industries).
i) Legend Valve.
j) NIBCO INC.
k) Sloane, George Fischer, Inc.
l) Spears Manufacturing Company.
m) Thermoplastic Valves Inc.
n) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a) Standard: MSS SP-122.
b) Pressure Rating: 150 psig.
c) Body Material: PVC.
d) Type: Union.
e) End Connections: Socket or threaded.
f) Port: Full.

E. Bronze Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a) American Valve, Inc.
b) Crane Co.; Crane Valve Group; Crane Valves.
c) Crane Co.; Crane Valve Group; Jenkins Valves.
d) Crane Co.; Crane Valve Group; Stockham Division.
e) Hammond Valve.

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f) KITZ Corporation.
g) Milwaukee Valve Company.
h) NIBCO INC.
i) Powell Valves.
j) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k) Zy-Tech Global Industries, Inc.

2. Description:
a) Standard: MSS SP-80, Type 2.
b) Class: 125.
c) CWP Rating: 200 psig.
d) Body Material: ASTM B 62 bronze with integral seat and screw-in bonnet.
e) Ends: Threaded or solder joint.
f) Stem: Bronze, nonrising.
g) Disc: Solid wedge; bronze.
h) Packing: Asbestos free.
i) Handwheel: Malleable iron, bronze, or aluminum.

F. Iron Gate Valves, Resilient Seated:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a) American AVK Company.
b) American Cast Iron Pipe Company; American Flow Control.
c) Clow Valve Co.; a division of McWane, Inc.
d) Kennedy Valve; a division of McWane, Inc.
e) M&H Valve; a division of McWane, Inc.
f) Mueller Co.; Water Products Division.
g) NIBCO INC.
h) U.S. Pipe.

2. Description:
a) Standard: AWWA C509.
b) Pressure Rating: 200 psig minimum.
c) Body Material: Ductile or gray iron with bronze trim.
d) End Connections: Mechanical joint or push-on joint.
e) Interior Coating: Comply with AWWA C550.
f) Body Design: Nonrising stem.
g) Operator: Stem nut.
h) Disc: Solid wedge with resilient coating.

G. Iron Gate Valve Casings:
1. Standard: AWWA M44 for cast-iron valve casings.
2. Top Section: Adjustable extension of length required for depth of burial of valve.
3. Barrel: Approximately 5-inch diameter.
4. Plug: With lettering "WATER."
5. Bottom Section: With base of size to fit over valve.
6. Base Support: Concrete collar.

H. Operating Wrenches for Iron Gate Valve Casings: Furnish two steel, tee-handle operating wrench(es) with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut for Project.

I. Iron Gate Valves, NRS:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a) Crane Co.; Crane Valve Group; Crane Valves.
b) Crane Co.; Crane Valve Group; Jenkins Valves.

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c) Crane Co.; Crane Valve Group; Stockham Division.
d) Flo Fab Inc.
e) Hammond Valve.
f) KITZ Corporation.
g) Legend Valve.
h) Milwaukee Valve Company.
i) NIBCO INC.
j) Powell Valves.
k) Red-White Valve Corporation.
l) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m) Zy-Tech Global Industries, Inc.

2. Description:
a) Standard: MSS SP-70, Type I.
b) CWP Rating: 200 psig.
c) Body Material: ASTM A 126, gray iron with bolted bonnet.
d) Ends: Flanged.
e) Trim: All bronze.
f) Disc: Solid wedge.
g) Packing and Gasket: Asbestos free.

J. Iron Gate Valves, OS&Y:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a) Crane Co.; Crane Valve Group; Crane Valves.
b) Crane Co.; Crane Valve Group; Jenkins Valves.
c) Crane Co.; Crane Valve Group; Stockham Division.
d) Flo Fab Inc.
e) Hammond Valve.
f) KITZ Corporation.
g) Legend Valve.
h) Milwaukee Valve Company.
i) NIBCO INC.
j) Powell Valves.
k) Red-White Valve Corporation.
l) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m) Zy-Tech Global Industries, Inc.

2. Description:
a) Standard: MSS SP-70, Type I.
b) CWP Rating: 200 psig.
c) Body Material: ASTM A 126, gray iron with bolted bonnet.
d) Ends: Flanged.
e) Trim: All bronze.
f) Disc: Solid wedge.
g) Packing and Gasket: Asbestos free.

2.06 PRESSURE-REDUCING VALVES

A. Water Regulators:

a) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
b) Cash Acme; a division of The Reliance Worldwide Corporation.
c) Conbraco Industries, Inc.; Apollo Valves.
d) Honeywell International Inc.
e) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
f) Zurn Plumbing Products Group; Wilkins Water Control Products.

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2. Description:
   a) Standard: ASSE 1003.
   b) Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
   c) Pressure Rating: Initial pressure of 150 psig.
   d) End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.
3. Capacities and Characteristics: As required by delegated design performance requirements and design criteria.

B. Water Control Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a) CLA-VAL Automatic Control Valves.
   b) Flomatic Corporation.
   c) OCV Control Valves.
   d) Watts ACV; a division of Watts Water Technologies, Inc.
   e) Zurn Plumbing Products Group; Wilkins Water Control Products.
2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
   a) Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
   b) Pattern: Angle or Globe-valve design.
   c) Trim: Stainless steel.
   d) Pressure Rating: Initial pressure of 150 psig minimum.
   e) End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
3. Capacities and Characteristics: As required by delegated design performance requirements and design criteria.

2.07 AUTOMATIC CONTROL VALVES

A. Plastic, Automatic Control Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a) Rain Bird Corporation
   b) Hunter Irrigation
   c) Nelson Irrigation

2. Description: Rain Bird type xxx-PESB electric remote control valve (1" through 2") mounted with Sch. 80 PVC ball valve with pressure regulation devices.
3. Globe-type diaphragm valves of normally closed design, with heavy-duty plastic and covers. Operation accomplished by means of an integrally mounted heavy-duty 24 volt AC solenoid complying with National Electrical Code, Class II Circuit, solenoid coil potted in epoxy resign within a plastic-coated stainless steel housing. Solenoids shall be completely waterproof, suitable for direct underground burial. Provide a flow stem adjustment in each valve.
4. Control valves shall be by the same manufacturer as the controller.

2.08 AUTOMATIC DRAIN VALVES

A. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig.

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2.09 TRANSITION FITTINGS

A. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a) Cascade Waterworks Manufacturing.
   b) Dresser, Inc.; DMD Division.
   c) Ford Meter Box Company, Inc. (The).
   d) JCM Industries.
   e) Smith-Blair, Inc; a Sensus company.
   f) Viking Johnson.
2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

C. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a) Harvel Plastics, Inc.
   b) Spears Manufacturing Company.
   c) Plasco Welding and Fabrication, Inc.
2. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a) Colonial Engineering, Inc.
   b) NIBCO INC.
   c) Spears Manufacturing Company.
2. Description: MSS SP-107, PVC four-part union. Include one brass or stainless-steel threaded end, one solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

2.10 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a) Capitol Manufacturing Company.
   b) Central Plastics Company.
   c) Epco Sales, Inc.
   d) Hart Industries International, Inc.
   e) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   f) Zurn Plumbing Products Group; Wilkins Water Control Products.
2. Description: Factory-fabricated union, NPS 2 and smaller.
   a) Pressure Rating: 150 psig minimum at 180 deg F.
   b) End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide

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products by one of the following:
a) Capitol Manufacturing Company.
b) Central Plastics Company.
c) Epco Sales, Inc.
d) Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
a) Pressure Rating: 175 psig minimum.
b) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a) Advance Products & Systems, Inc.
b) Calpico, Inc.
c) Central Plastics Company.
d) Pipeline Seal and Insulator, Inc.
2. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.
a) Pressure Rating: 150 psig minimum for lateral or sub-main pipe and 200 psig for main lines.
b) Gasket: Neoprene or phenolic.
c) Bolt Sleeves: Phenolic or polyethylene.
d) Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a) Calpico, Inc.
b) Lochinvar Corporation.
c) Watts Water Technologies
2. Description: Galvanized-steel coupling.
a) Pressure Rating: 300 psig at 225 deg F.
b) End Connections: Female threaded.
c) Lining: Inert and noncorrosive, thermoplastic lining.

F. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a) Perfection Corporation.
b) Precision Plumbing Products, Inc.
c) Victaulic Company.
2. Description: Electroplated steel nipple complying with ASTM F 1545.
a) Pressure Rating: 300 psig at 225 deg F.
b) End Connections: Male threaded or grooved.
c) Lining: Inert and noncorrosive, propylene.

2.11 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI WH 201, with bellows or piston-type pressurized cushioning chamber and in sizes complying with PDI WH 201, Sizes A to F.

B. Pressure Gages: ASME B40.1. Include 4-1/2-inch- diameter dial, dial range of two times system operating pressure, and bottom outlet.

2.12 SPRINKLERS

A. General Requirements: Designed for uniform 110% coverage over entire area indicated at available water pressure determined by irrigation contractor.

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Irrigation contractor shall list available pressure within shop drawings.

B. Pop-Up Lawn Spray Sprinklers:
   1. Basis-of-Design Product: Provide Rain Bird Series 1806-SAM 6" Pop-up lawn spray sprinkler for full, half, and quarter radii and side and end strips for coverage as required, 30 psi or equal product by Hunter Irrigation or Nelson Irrigation
   2. Capacities and Characteristics: As required by the delegated design performance requirements and design criteria.

C. Lawn Spray Sprinklers:
   1. Basis-of-Design Product: Provide Rain Bird Series 1806-SAM 6" lawn spray sprinkler for side and end strips for coverage as required, 30 psi or equal product by Hunter Irrigation or Nelson Irrigation.
   2. Capacities and Characteristics: As required by the delegated design performance requirements and design criteria.
   3. Utilize Rain Bird SA series Swing Assembly for each head.

D. Lawn Rotors:
   1. Basis-of-Design Product: Provide Rain Bird Series 5000 Lawn Rotors, or equal, for full, half, and quarter radii as required or equal product by Hunter Irrigation or Nelson Irrigation.
   2. Capacities and Characteristics: As required by the delegated design performance requirements and design criteria.
   3. Utilize Rain Bird TSJ series Swing Assembly for each head.

E. Shrub Sprinklers:
   1. Basis-of-Design Product: Provide Rain Bird Series 1812-SAM 12" HI-POP Shrub Spray for full, half, and quarter radii, and side strip and end strip spray sprinklers coverage applications or equal product by Hunter Irrigation or Nelson Irrigation.
   2. Capacities and Characteristics: As required by the delegated design performance requirements and design criteria.
   3. Utilize Rain Bird SA series Swing Assembly for each head.

F. Driplines:
   1. Basis-of-Design Product: Provide Rain Bird Series XFD dripline or equal product by Hunter Irrigation or Nelson Irrigation.

G. Turf Rotors for Athletic Fields:
   1. Basis of Design Product: Provide Nelson Pro 7500, with #5 Nozzle, sports turf closed case rotor, for full circle and part arc, 56' radius @ 12 gpm, 50 psi, rubber cover, stainless steel riser. Utilize Lasco 1" unitized swing joints.

2.13 CONTROLLERS

A. The existing controller is located on the exterior of Mechanical Room 1301-M3 at the current high school building and shall be utilized for irrigation of this project. The controller is a Hunter ACC-99D. Additional modules shall be added as needed for this project leaving a minimum of 4 spaces.
   1. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.
      a) Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
      b) Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
      c) Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial. All splices shall be made in valve boxes. No splicing between boxes is acceptable.

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First example shall stay open until Architect approves.

2.14 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a) Armorcast Products Company.
   b) Carson Industries LLC.
   c) Nationwide Plastics, Inc.
   d) NewBasis.
   e) Oldcastle, Inc.
   f) Orbit Irrigation Products, Inc.
   g) USFilter/Plymouth Products, Inc.
   h) Ameteck.
2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
   a) Size: As required for valves and service.
   b) Shape: Round or Rectangular.
   c) Sidewall Material: PE or ABS.
   d) Cover Material: PE or ABS.
      1) Lettering: " IRRIGATION."
3. All valve boxes shall be installed on at least a two (2) cubic foot gravel base to provide foundation and drainage. All valve box elevations shall be ½" below finished grade.

B. Polymer-Concrete Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a) Armorcast Products Company.
   b) Carson Industries LLC.
   c) CDR Systems Corporation.
   d) Christy Concrete Products.
   e) NewBasis.
   f) Strongwell Corporation; Lenoir City Division.
2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
   a) Size: As required for valves and service.
   b) Shape: Round or Rectangular.
   c) Sidewall Material: Polymer concrete with lateral and vertical sidewall design loading of 10,000 lb minimum over 10 by 10 inches square.
   d) Cover Material: Reinforced polymer concrete with cover design loading of 10,000 lb minimum over 10 by 10 inches square. 1) Lettering: " IRRIGATION."

C. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch minimum to 3 inches maximum.

2.15 SLEEVES

A. All sleeves shall be Schedule 80 PVC or stronger. Sleeves are required where piping extends below paving or other appurtenances.

B. All sleeves shall be installed under proposed pavement areas prior to subgrade and base construction.

C. Sleeves shall have a minimum horizontal separation of 18" and a maximum of twenty-four (24) inch clearance below bottom of curb.

D. All sleeves shall have a minimum horizontal separation of twenty-four (24) and maximum of thirty-six inches from center to center.

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E. Stub up sleeve pipe twelve (12) inches above ground surface and cap. Paint cap with fluorescent orange paint for easy identification.

F. The location of all sleeves shown on the plans is schematic. The Contractor shall make any adjustments necessary to accommodate existing vegetation, utilities, or other existing conditions.

2.16 THRUST BLOCKS

A. Place one cubic ft. of concrete for each inch of pipe diameter for thrust block. Thrust shall not allow vertical or horizontal movement of pipe in any direction unless otherwise noted on design. Thrust blocking shall be provided on all piping two and one half (2 1/2) inch diameter and larger.

PART 3 - EXECUTION

3.03 EARTHWORK

A. Excavating, trenching, and backfilling are specified in specification Section "Earthwork."

B. Trenches for pipe sprinkler lines shall be excavated of sufficient depth and width to permit proper handling and installation by any other method the Contractor may desire if approved by the Owner, pipe manufacturer, and Architect. The backfill shall be thoroughly compacted and evened off with the adjacent soil level. Selected fill dirt or sand shall be used if soil conditions are rocky. In rocky areas the trenching depth shall be two (2) inches below normal trenching depth to allow for this bedding.

C. The Contractor shall backfill in six (6) inch compacted lifts as needed to bring the soil to its specified compaction and density.

D. In the spring following the year of installation, the Contractor shall repair any settlement of the trenches by bringing them to grade with topsoil, and seeding with the existing lawn type(s). Watering and maintenance of the repaired areas shall be the Owner's responsibility.

E. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.

F. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 1.2" to ¾", to 12 inches below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.

G. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 24 inches below finished grade except under pavement a minimum of 30 inches in sleeve.
2. Circuit Piping: 18 inches.
3. Drain Piping: 18 inches.
4. Sleeves: 30 inches.

3.04 PREPARATION

A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

3.05 PIPING INSTALLATION

A. Location and Arrangement: Install piping per approved shop drawings unless deviations are approved by Owner or Architect. All piping shall be inspected by the Owner or Architect prior to backfilling.

B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

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E. Install fittings for changes in direction and branch connections.
F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.
G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.
H. Lay piping on solid subbase, uniformly sloped without humps or depressions.
I. Install ductile-iron piping according to AWWA C600.
J. Installation of Plastic Pipe:
    1. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing. All piping shall be inspected by the Owner or Architect prior to backfilling.
    2. Plastic pipe shall be installed in a manner that permits expansion and contraction as recommended by the manufacturer. Install expansion loops in control-valve boxes for plastic piping.
    3. Plastic pipe shall be cut with a handsaw or hacksaw with the assistance of a square in sawing vice or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.
    4. All plastic-to-plastic joints shall be solvent weld joints or slip seal (gasketed) joints. Only the solvent recommended for the pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer. The Contractor shall assume full responsibility for the correct installation.
    5. The joints shall be allowed to set at least twenty-four (24) hours before pressure is applied to the system on PVC pipe.
    6. All pipe for irrigation system shall be Sch 40 PVC as specified
    7. Install continuous, underground, detectable warning tapes over underground piping during backfilling of trenches
K. Install (1) PVC ball valve in same box as each automatic control valve.
L. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.
M. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.
N. Install piping in sleeves under parking lots, roadways, and sidewalks.
O. Install sleeves made of Schedule 80 PVC pipe and socket fittings, and solvent-cemented joints.
P. Install transition fittings for plastic-to-metal pipe connections according to the following:
    1. Underground Piping:
        a) NPS 1-1/2 and Smaller: Plastic-to-metal transition fittings.
        b) NPS 2 and Larger: AWWA transition couplings.
    2. Aboveground Piping:
        a) NPS 2 and Smaller: Plastic-to-metal transition fittings.
        b) NPS 2 and Larger: Use dielectric flange kits with one plastic flange.

Q. Install dielectric fittings for dissimilar-metal pipe connections according to the following:
    1. Underground Piping:
        a) NPS 2 and Smaller: Dielectric coupling or dielectric nipple.
        b) NPS 2-1/2 and Larger: Prohibited except in control-valve box.
    2. Aboveground Piping:
        a) NPS 2 and Smaller: Dielectric union.

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b) NPS 2-1/2 to NPS 4: Dielectric flange.
c) NPS 5 and Larger: Dielectric flange kit.

3. Piping in Control-Valve Boxes:
a) NPS 2 and Smaller: Dielectric union.
b) NPS 2-1/2 to NPS 4: Dielectric flange.
c) NPS 5 and Larger: Dielectric flange kit.

R. Irrigation piping shall be installed below drainage laterals.

S. Irrigation piping shall be pressure tested and inspected prior to covering.

3.06 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.

F. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners according to piping manufacturer's written instructions.

G. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Non-pressure Piping: Join according to ASTM D 2855.

3.07 VALVE INSTALLATION

A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.

B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.
1. Install valves and PVC pipe with restrained, gasketed joints or with thrust blocks, appended.

C. Aboveground Valves: Install as components of connected piping system.

D. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves.

E. Throttling Valves: Install in underground piping in boxes for automatic control valves.

F. Drain Valves: Install in underground piping in boxes for automatic control valves.

3.08 SPRINKLER INSTALLATION

A. Install sprinklers after hydrostatic test is completed.

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B. Install sprinklers at manufacturer's recommended heights.
C. Locate part-circle sprinklers to maintain a minimum distance of 12 inches from walls and 4 inches from curbs or sidewalks.

3.09 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

A. Install control cable in same trench as irrigation piping and at least 2 inches below piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.
B. All electrical connections shall conform to the National Electrical Code, latest edition.
C. Control wires installed beneath walks, drives, or other permanent surface shall be placed in sleeves.
D. Wires shall be spliced only at valve boxes.
E. Leave twenty-four (24) inch loop of wire at each valve for expansion/contraction and servicing.
F. Controllers and valves shall be from the same company
G. 120 VAC electrical power supply to the controller location shall be supplied by electrical contractor.

3.10 CONNECTIONS

A. Comply with requirements for piping specified in specification Section "Water Distribution " for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.
C. Connect wiring between controllers and automatic control valves.

3.11 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."
B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.
    1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches.

3.12 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
B. Flushing, perform tests and inspections.
    1. After all new sprinkler piping and risers are in place and connected for a given section and all necessary division work has been completed and prior to the installation of sprinkler heads all control valves shall be opened and a full head of water used to flush out the system.
    2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
    3. Sprinkler main shall be tested under normal water pressure for a period of twelve (12) hours. If leaks occur, repair and repeat the test. Give Architect twenty-four hours notice prior to testing.

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4. Testing of the system shall be performed after completion of the entire installation and any necessary repairs shall be made at the Contractor's expense to put the system in good working order before final payment by the Owner.
5. Adjustment of the sprinkler heads, and automatic equipment will be done by the Contractor upon completion of installation to provide optimum performance. Minor adjustments during the guarantee period will be made by the Owner.
6. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Any irrigation product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.13 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. Verify that controllers are installed and connected according to the Contract Documents and the Delegated Design Documents.
3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.14 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.15 CLEANING

A. During irrigation work, Contractor shall keep project site clean and orderly.

B. Upon Completion of Work, clear grounds of debris, superfluous materials and all equipment. Remove from site to satisfaction of the Owner's Representative.

3.16 WINTERIZING THE SYSTEM

A. Contractor's responsibility to winterize the irrigation system the first winter following Substantial Completion of the Project and instruct Owner's personnel on winterization practices.

3.17 INSPECTION

A. Periodic inspections will be made by the Architect/Owner's Representative to review the quality and progress of the work. Work found to be unacceptable must be corrected within a timely mater (to be determined by Owner's Representative). Remove rejected materials promptly from the project site.

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3.18 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic control valves and controllers.

3.19 PIPING SCHEDULE

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control-valve boxes and aboveground may be joined with flanges or unions instead of joints indicated.

C. Aboveground irrigation main piping, NPS 2" and smaller, shall be one of the following:
   1. Galvanized pipe must conform to the requirements of ASTM A120. The pipe shall be "standard weight", unless otherwise specified.

D. Aboveground irrigation main piping, NPS 2 1/2" and larger, shall be one of the following:
   1. Ductile iron pipe conforming to the requirements of ANSI Standard A21.51 and AWWA C151. All pipe shall be class 350. Class designations for the various classes of pipe shall be painted on the outside of each joint of pipe. Weights shall be conspicuously paintedin white on each joint of pipe after the bituminous coating has hardened. Pipe shall be coated inside and out with one mil. thick bituminous coating conforming to ANSI A21.4 and AWWA C110 or C151. The interior shall be lined with a cement mortar lining conforming to ANSI/AWWA C104/A21.4.

E. Underground irrigation main piping up to NPS 4" shall be one of the following:
   1. Schedule 40, PVC pipe and push-on fittings, and gasketed joints.
   2. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.

F. Underground irrigation main piping, NPS 5 and larger, shall be one of the following:
   1. Schedule 40, PVC pipe and push-on fittings, and gasketed joints.
   2. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.

G. Circuit piping, NPS 2 and smaller, shall be one of the following:
   1. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.

H. Circuit piping, NPS 2-1/2 to NPS 4, shall be one of the following:
   1. Schedule 40, PVC pipe and PVC gasketed fittings;

I. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.
   1. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.

J. Risers to Aboveground Sprinklers and Specialties: Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.

K. Drain piping shall be one of the following:
   1. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.

3.20 3.18 VALVE SCHEDULE

A. Underground, Shutoff-Duty Valves: Use the following:
   1. NPS 2 and Smaller: Curb valve, curb-valve casing, and shutoff rod.
   2. NPS 3 and Larger: Iron gate valve, resilient seated; iron gate valve casing; and operating wrench(es).

B. Aboveground, Shutoff-Duty Valves:
   1. NPS 2 and Smaller: Brass or bronze ball valve.
   2. NPS 2 and Smaller: Bronze gate valve.

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3. NPS 2-1/2 and Larger: Iron ball valve.
4. NPS 2-1/2 and Larger: Iron gate valve, NRS.

C. Throttling-Duty Valves:
1. NPS 2 and Smaller: Brass automatic control valve.
2. NPS 2 and Smaller: Brass, bronze or plastic ball valve.
3. NPS 2-1/2 and NPS 3: Brass or Bronze automatic control valve.
4. NPS 2-1/2 and NPS 3: Iron ball valve.

D. Drain Valves:
E. NPS 1/2 and NPS 3/4: Automatic drain valve.
F. NPS 1/2 and NPS 3/4: Bronze gate valve.
G. NPS 1 to NPS 2: Bronze gate valve.

END

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SECTION 02810
PLANTING IRRIGATION

APPENDIX

Description	**Pages**
General Notes.	A-1

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SECTION 328400

PLANTING IRRIGATION

GENERAL NOTES

1. All mainlines to have a minimum of 30" of cover. (Sch 40 PVC Pipe).
2. All Lateral and sub-main pipe to have a minimum of 18" of cover. (Sch 40 PVC Pipe)
3. No rocks, boulder, or other extraneous materials to be used in backfilling of trench.
4. All pipe to be installed as per manufacturer's specifications.
5. All threaded joints to be coated with Teflon Tape or Liquid Teflon
6. All lines to be thoroughly flushed before installation of sprinkler heads.
7. Sprinkler and related equipment to be installed as per details.
8. All electrical joints to be made using waterproof connections using manufacturers recommended product.
9. All equipment not specified in the legend shall be determined and furnished by the Contractor.
10. No electrical connections shall be made in the field except at a valve control box or another valve box specifically for connections.
11. All 24 volt wire shall be #12 UF/UL for common wire, and #14 UF/UL for control wires, direct burial, solid copper.
12. Contractor to be responsible for proper coverage of areas to be watered, i. e. adjust heads with insufficient coverage due to blockage by existing or proposed site features.
13. Contractor to refer to landscape plan to keep sprinkler equipment and accessory material from interfering with proper planting, i. e. verify root ball size for planting.
14. Contractor shall provide expansion coils at each wire connection in valve box (wrap around ¾" pipe 12 times).
15. Contractor to utilize appropriate automatic drain device where low head drainage may occur.
16. Contractor shall utilize valve I. D. tags on all remote control valves.
17. 24 volt wire shall be color coded; common-white, control-red.
18. Contractor shall install manufacturers' recommended grounding equipment for power supply and valve output with (2) 5/8" copper clad ground rods.
19. Contractor shall install manufacturers' recommendation on fault ground and lightning protection.
20. All material to be supplied by Contractor to Owner:
    A. Two wrenches for disassembling and adjusting each type of sprinkler heads and valve supplied.
    B. Two keys for each of the automatic controllers.
21. System is diagrammatic to improve clarity. All mainline piping electric valves and wiring are to be installed in landscape areas and within property boundaries. Contractor shall reference the landscape plan prior to the installation of piping to avoid contact with plant materials existing or new.
22. Contractor to add extension riser to pop-up heads when needed for proper coverage.
23. Contractor shall install sprinkler equipment 12" from foundations. Also install sprinklers 4" from curb or walks.
24. Irrigation Contractor shall provide the Owner and Architect with a reproducible cross measured as-built drawing of the installed irrigation system in AutoCAD 2009 format before final acceptance.
25. A 1-year warranty period shall be provided for system after substantial completion is accepted. Start up and adjusting of system in springtime shall be included in warranty. Contractor shall consult with Architect for proper watering rates during the three (3) month grow in period. Contractor will be responsible for maintenance and adequate watering rates during the contract period.
26. All piping shall be inspected by the Owner or Architect prior to backfilling.

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SECTION 329115

SOIL PREPARATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes planting soils specified according to performance requirements of the mixes.

B. Related Requirements:

1. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.

1.03 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.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

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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 **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.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.
B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
    1. Laboratories: Subject to compliance with requirements, provide testing by the following:
        a) Tifton Soil Physical Laboratory, 1412 Murray Avenue, Tifton, GA 31794.

1.07 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: **Engage** a qualified testing agency to perform preconstruction soil analyses on **existing, on-site soil**.
    1. Notify Architect **seven** 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.

1.08 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 Contractor in presence of Architect under the direction of the testing agency.
    1. Number and Location of Samples: Minimum of **eigh** representative soil samples **where directed by Architect** 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.

1.09 TESTING REQUIREMENTS

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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 **one of** 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.
   2. Bulk Density: Analysis according to **core method** of SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
   3. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
   4. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
   5. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85 percent compaction according to ASTM D698 (Standard Proctor).
C. Chemical Testing:
   1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
   2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
D. Fertility Testing: Soil fertility analysis according to standard laboratory protocol of **SSSA NAPT SERA-6**, including the following:
   1. Percentage of organic matter.
   2. CEC, calcium percent of CEC, and magnesium percent of CEC.
   3. Soil reaction (acidity/alkalinity pH value).
   4. Buffered acidity or alkalinity.
   5. Nitrogen ppm.
   6. Phosphorous ppm.
   7. Potassium ppm.
   8. Manganese ppm.
   9. Manganese-availability ppm.
   10. Zinc ppm.
   11. Zinc availability ppm.
   12. Copper ppm.
   13. Sodium ppm[and sodium absorption ratio].
   14. Soluble-salts ppm.
   15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
   16. Other deleterious materials, including their characteristics and content of each.
E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3-Chemical Methods."
F. 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.

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1. Fertilizers and Soil Amendment Rates: State recommendations in weight per **1000 sq. ft. (100 sq. m)** for **6-inch (150-mm)**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. (100 sq. m) for 6-inch (150-mm)depth of soil**.

1.10 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

2.01 PLANTING SOILS SPECIFIED ACCORDING TO PERFORMANCE REQUIREMENTS

A. Planting-Soil Type : Existing, on-site surface soil, with the duff layer, if any, retained**; and stockpiled on-site**; modified to produce viable planting soil. Using preconstruction soil analyses and materials specified in other articles of this Section, amend existing, on-site surface soil to become planting soil complying with the following requirements:

1. Particle Size Distribution by USDA Textures: Classified as **sandy loam**-soil according to USDA textures.
2. Fragment Size Distribution:
   a) Fine Fragments: Maximum 10 percent by dry weight.
   b) Medium Fragments: Maximum 60 percent by dry weight.
   c) Coarse Fragments: Maximum 20 percent by dry weight.
   d) Sticks and Roots: Maximum 5 percent by dry weight.
   e) Debris and Other Foreign Materials: Maximum 5 percent by dry weight.
3. Percentage of Organic Matter: Minimum **3** percent by volume.
4. Soil Reaction: pH of 6 to 7 .
5. CEC of Total Soil: Minimum **7** meq/100 mL at **pH of 7.0**.
6. CEC of Clay Fraction: Maximum **15** meq/100 mL at **pH of 7.0**.
7. Soluble-Salt Content: [**5 to 10**] <**Insert range or value**> dS/m measured by electrical conductivity.
8. Bulk Density: **1.0** g/cu. cm to **1.5** g/cu. cm at 85 percent compaction.
9. Total Porosity: Minimum **45** percent at 85 percent compaction.
10. Macro Porosity: Minimum **10** percent at 85 percent compaction.

2.02 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through a No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through a No. 60 (0.25-mm) sieve.
2. Form: Provide lime in form of ground dolomitic limestone.

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B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through a No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to **ASTM C33/C33M**.

2.03 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:

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a **1/2-inch (13-mm)** sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of **maximum 5** dS/m.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a **1/2-inch (13-mm)** sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of **maximum 5** dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

D. 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. (2.4 kg/cu. m)** of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of **0.25 lb/cu. ft. (4 kg/cu. m)** of loose sawdust or ground bark.

2.04 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.

PART 3 - EXECUTION

3.01 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.

3.02 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Excavation: Excavate soil from designated area(s) to a depth of **6 inches (150 mm)** and stockpile until amended if construction operations require removal.

B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpen-

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tine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

C. Unsuitable Materials: Clean soil to contain a combined maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

D. Screening: Pass unamended soil through a **3-inch (75-mm)** sieve to remove large materials.

3.03 BLENDING PLANTING SOIL IN PLACE

A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of **6 inches (150 mm)**. Remove stones larger than **1-1/2 inches (38 mm)** in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

1. Mix **lime and sulfur** with dry soil before mixing fertilizer.
2. Mix fertilizer with planting soil no more than seven days before planting.

D. Compaction: Compact blended planting soil to **75 to 82** percent of maximum Standard Proctor density according to ASTM D698.

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.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Perform the following tests **and inspections**:

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D698. Space tests at no less than one for each **1000 sq. ft. (100 sq. m)** of in-place soil or part thereof.
2. Performance Testing: For each amended planting-soil type, demonstrating compliance with specified performance requirements. Perform testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

C. Soil will be considered defective if it does not pass tests **and inspections**.

D. Prepare test **and inspection** reports.

E. 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.

3.05 PROTECTION

A. 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. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.

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B. 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.

3.06 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 329115

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SECTION 329200

TURF AND GRASSES (SOD)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Sodding.
B. Related Requirements:

1.03 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.
B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See **Section 329115 "Soil Preparation"** and drawing designations for planting soils.
E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.
B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, 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 **turfgrass sod**. Include identification of source and name and telephone number of supplier.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
   1. Experience: **Five** years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
   2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

1.07 TURFGRASS SOD

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A. Turfgrass Sod: **Certified**, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.
B. Turfgrass Species: Bermudagrass (Cynodon dactylon).

1.08 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 soil-testing laboratory.

1.09 PESTICIDES
A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended 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.
B. 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.
C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 2 - EXECUTION

2.01 EXAMINATION
A. Examine areas to be planted for compliance with requirements and other 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. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

2.02 PREPARATION
A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
1. Protect grade stakes set by others until directed to remove them.
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.

2.03 TURF AREA PREPARATION

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A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation.".
B. Placing Planting Soil: Blend planting soil in place.
   1. Reduce elevation of planting soil to allow for soil thickness of sod.
C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
D. Before planting, obtain Architect's acceptance of finish grading; restore planting

2.04 SODDING

A. Lay sod within 24 hours of harvesting **unless a suitable preservation method is accepted by Architect prior to delivery time**. Do not lay sod if dormant or if ground is frozen or muddy.
B. 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 soil or sod during installation. Tamp and roll lightly to ensure contact with soil, 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 slopes exceeding 1:3.
   2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil

2.05 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
   1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
   2. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm) unless permanent irrigation system is operational.
   1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
   2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.
C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third 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 the following grass height:
   1. Mow **bermudagrass** to a height of 1/2 to 1 inch (13 to 25 mm).
D. Turf Postfertilization: Apply **commercial fertilizer** after initial mowing and when grass is dry.
   1. Use fertilizer that provides actual nitrogen of at least **1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m)** to turf area.

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2.06 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:
   1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

2.07 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

2.08 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. 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. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
D. Remove nondegradable erosion-control measures after grass establishment period.

2.09 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
   1. Sodded Turf: Substantial Completion.

END OF SECTION 329200

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SECTION 329210
GRASSING

PART 1 - GENERAL

1.01 APPLICABLE STANDARDS

A. Conform to Section 700 and other applicable articles of the "Standard Specifications Construction of Roads and Bridges", of the Department of Transportation, State of Georgia, 2001 Edition (or latest version). Omit all references to measurement and payment.

1.02 SOIL SAMPLES

A. The Contractor shall take soil samples from several areas of the site to be grassed and have them analyzed by the Georgia Extension Service, or other laboratory approved by Engineer/Architect. The results of the analysis shall determine the best fertilizer mixture to use on the site.

PART 2 - MATERIALS

2.01 FERTILIZER

A. Commercial Fertilizer: Fertilizer for lawns shall be a complete fertilizer, the nitrogen content of which shall be derived from either organic or inorganic sources and meeting the following minimum requirements of plant food by weight, unless the soil analysis and report indicates a need for a different fertilizer mixture in which case the recommended mixture shall be furnished and applied. All State and Federal laws relative to fertilizer must be complied with.

10% Nitrogen - 12% Phosphoric Acid - 12% Potash

B. Ground Limestone: Lime shall be ground dolomitic limestone containing not less than 85% of total carbonates and shall be ground to such fineness that 50% will pass through a 20-mesh sieve. Coarser material will be acceptable, provided the specified rates of application are increased proportionately on the basis of quantities passing the 100-mesh sieve.

C. Sodium Nitrate shall be a commercial product in dry powder form and shall be delivered in the original, unopened containers each bearing the manufacturer's guaranteed statement of analysis. It shall contain not less than 16% Nitrogen.

2.02 LAWN MATERIALS

A. Bermuda Grass (Cyanodon Dactylon): Seed shall be 98% minimum purity and 85% germination.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prepare the seed bed by thoroughly cultivating, discing and hand raking as necessary to produce a smooth even grade free from hollows or other inequalities. Before any seeding is attempted the soil must be in a well pulverized, smooth, friable condition of uniformly fine texture.

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3.02 FERTILIZING AND LIMING

A. Approximately two (2) days prior to the start of seeding operations, apply ground limestone at the rate of 20 pounds per 1000 sq. ft. of lawn area. Either in conjunction with the above operation or immediately afterwards apply the specified Commercial Fertilizer over all lawn areas at the rate of 30 pounds per 1000 sq. ft. of lawn area. Work limestone into the top 6 inches of ground and the fertilizer into the top 2 inches of ground.

B. When the grass has started to cover well (approximately 4 weeks after sowing seed) apply 1-1/2 pounds of Ammonium Nitrate to all lawn areas and immediately water using a fine spray. At the end of the maintenance period and prior to the final inspection apply 10 pounds of the specified Commercial Fertilizer per 1000 sq. ft. of lawn area and immediately water.

3.03 SEEDING & SODDING

A. Before any seeding and/or sodding are attempted the soil must be in a well pulverized, smooth, friable condition of uniformly fine texture. Lawn areas shall be seeded evenly with a mechanical spreader at the rate of 2 lbs. of seed per 1000 sq. ft., 50% in one direction and the remainder sown at right angles to first sowing. The seeded areas shall be lightly raked, rolled with a suitable weight roller and watered with a fine spray.

B. Fescue planting season shall be as approved by Engineer.

C. Bermuda Grass seeding shall be planted only between May 1 to September 1.

D. When grassing is required between curbs and sidewalks, behind sidewalks in areas adjacent to private property, the Engineer may change the type of seeding or sodding to that required to match any type of grass which may be planted and growing on the adjacent lawn. No increase in the Contract Sum will be made for this substitution.

3.04 WATERING

A. Soak soil to a minimum depth of 6 inches immediately after seeding. Do not wash away soil or seed. Keep all surfaces continuously moist thereafter until 30 days after the lawn has been seeded. Use fine spray nozzles only.

3.05 RESPONSIBILITY

A. Maintenance of grass areas shall consist of watering, weeding, cutting, repair of any erosion and reseeding or re-sodding as necessary to establish a uniform stand of the specified grasses, and shall continue until final acceptance.

B. All grassed areas that do not show satisfactory growth within 15 days after sowing shall be re-sown and re-fertilized as directed until a satisfactory blanket is established. Approximately 3 weeks after sowing the last seed, but not before the seed has taken hold and the grass is growing well, apply sulfate of ammonia or sodium nitrate at the rate of 300 pounds to the acre and water immediately. The lawns shall be considered established when they are reasonably free from weed, green in appearance and the specified grass is vigorous and growing well on each square foot of lawn area. Full coverage is required in 60 days.

C. All grassed areas shall be protected until accepted. All eroded and damaged areas, regardless of cause, shall be immediately repaired and reseeded. Protect lawn areas against traffic.

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D. Grassed areas shall be covered evenly with a loose layer of clean wheat, rye, oats, Serecia Lespedeza or Coastal Bermuda Hay. Two tons of dry mulch shall be applied to each acre seeded. Hay shall be placed during calm weather with no wind.

E. As soon as the grass becomes established, a final inspection of the work will be made, provided a written request for such inspection is given to the Engineer. Satisfactory coverage is defined as coverage of the areas seeded with grass that is alive and growing, leaving no bare spots larger than one (1) square foot with 98% coverage.

F. All temporary valves, cutoffs and piping shall be removed by the Contractor at final acceptance of the grassing.

END.

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SECTION 331410
ONSITE WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

C500 Gate Valves 3" - 48" for Water and Other Liquids

C502 Dry-Barrel Fire Hydrants

C600 Installation of Cast Iron Water Mains

C601 Disinfecting Water Mains

C800 Threads for Underground Service Line Fittings

B. American National Standards Institute (ANSI):

A-21.10 Gray-Iron and Ductile Iron Fittings, 2"-48" for Water and Other liquids

A-21.11 Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe Fittings

A-21.4 Cement Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water

A-21.51 Ductile Iron Pipe, Centrifugally Cast in Metal or Sand-Lined Molds, for Water or Other Liquids

B-18.2 Square and Hex-Head Bolts and Screws

C. American Society of Testing and Materials (ASTM):

A-47 Malleable Iron Castings

A-48 Gray Iron Casting

A-88 Seamless Copper Water Tube

A-240 Chromium and Chromium-Nickel Stainless Steel Plate Sheet and Strip for Fusion-Welded Uni-fired Pressure Vessels

A-307 Low Carbon Steel Externally and Internally Threaded Standard Fasteners

D-1784 Rigid Poly (Vinyl chloride) Compounds, and Chlorinated Poly (Vinyl Chloride) Compounds

D-2239 Polyethylene (PE) Plastic Pipe (SDR-PR)
D-2241 Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR and Class T)

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D-3139 Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals

D. Rule for Safe Drinking Water, Georgia State EPD: Chapter 391-3-5

1.02 DESCRIPTION

A. All valves of the same type shall be from a single manufacturer. Parts for valves of the same type and size shall be interchangeable. Spare parts shall be furnished where required in the payment items. Special tools required for repacking or dissembling valves shall be provided.

B. All valves shall open left (counter-clockwise).

1.03 SUBMITTALS

A. Six copies of manufacturer's drawings and catalog cuts of the following items shall be submitted for approval of the Design Engineer and the General Contractor:

1. Pipe
2. Fittings
3. Joints and Couplings
4. Hydrants
5. Valves

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Materials delivered to site shall be inspected for damage, unloaded and stored with the minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and rubber gaskets under cover and protect from exposure to direct sunlight. Store materials above ground. Interior of pipe and fittings shall be kept free of dirt and debris.

B. Pipe, fittings, valves, hydrants and other accessories shall be handled to insure delivery to the point of installation in sound undamaged condition. If coatings or linings of pipe or fittings are damaged, such pipe or fittings shall be removed from the site and new materials furnished. Pipe shall not be dragged. Rubber gaskets that are not installed immediately shall not be left in the sunlight, but shall be stored under cover and protected from exposure to direct sunlight.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE (PVC)

A. DIP Size PVC Pipe: AWWA C-900-07

1. C-900 polyvinyl chloride water main pipe 4” TO 12” shall conform to Designation ASTM D2241 and shall consist of Type I, Grade 1 PVC compound conforming to ASTM D1784. All pipe larger than 4” to 12” shall meet the requirements of AWWA C900, “Poly Vinyl Chloride (PVC) pressure pipe.” All pipe shall be class 235 rated pipe and shall meet the requirements of DR18. The standard laying length shall be 20 ft. ±1 inch.

2. C-905 polyvinyl chloride water main pipe 14” to 30” shall be manufactured from compounds conforming to PVC cell classification of 12454B as defined in ASTM D-1784. The integral bell joint system meets the requirements of ASTM D-3139 and utilizes an elastomeric seal

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conforming to ASTM F-477. All pipe shall be class 200 pipe and shall meet the requirements of DR18. The standard laying length shall be 20 ft. ±1 inch.

B. When DIP size PVC pipe is used 2" PVC pipe shall be SDR 21, 200 PSI pressure class, iron pipe

C. Pipe shall have integral bell and spigot joints. Provisions shall be made for contraction and expansion at each joint with an elastomeric ring. Threaded or solvent welded type joints shall not be used. Bell end pipe and couplings with elastomeric gaskets shall meet the requirements of ASTM 3139.

D. The Contractor shall install a continuous run of 14 gauge solid copper tracer wire with underground coating above the top of the PVC pipe 12 inches above the pipe but no deeper than 48 inches below finished grade. The tracer wire shall be suitable for detection with metal pipe location equipment. Copper clad tracer wire shall not be used.

E. All water pipe shall be blue in color and labeled "water" every three feet as a minimum.

F. Pipe shall carry National Sanitation Foundation (NSF) seal and be factory marked with manufacturer's identification, pipe size, material and pressure rating.

2.02 DUCTILE IRON PIPE

A. Ductile iron pipe shall conform to the requirements of ANSI Standard A21.51 and AWWA C151. All pipe shall class 350. Class designations for the various classes of pipe shall be painted on the outside of each joint of pipe. Weights shall be conspicuously painted in white on each joint of pipe after the bituminous coating has hardened.

B. All joints shall have the same pressure rating as the pipe with which it is used. Joints shall be rubber gasketed push on or mechanical joint. Joints shall meet the requirements of ANSI A21.11 and AWWA C111.

C. Pipe shall be coated inside and out with one mil. thick bituminous coating conforming to ANSI A21.4 and AWWA C110, C115OR C151. The interior shall be lined with a cement mortar lining conforming to ANSI/AWWA C104/A21.4.

2.03 GALVANIZED STEEL PIPE

A. This pipe and fittings shall conform to the requirements of ASTM A120. The pipe shall be "standard weight", unless otherwise specified.

2.04 PLASTIC TUBING

A. Plastic pipe shall conform to all the requirements of the "Specifications for Polyethylene (PE) Plastic Pipe (ADR-PR)", as they apply to PE 3306 of ASTM D2239.

B. The hydrostatic design stress shall be 630 psi for water at 23° centigrade (73.4° F) and 500 psi for water at 37.8° C (100° F).

C. The polyethylene extrusion compound from which the pipe is extruded shall meet the requirements of Type III, Grade 3, Class C material as described in "Specification for Polyethylene Molding and Extrusion Materials", ASTM D1248, except that melt index shall be determined under a higher temperature than any of the conditions as listed in Section 6(b) of "Method of Test for Measuring Flow Rates of Thermoplastics by Extrusion Plastometer", ASTM D1238. The test

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condition shall be the same as for condition J, except that the temperature shall be 310° C (590° F), with a load of 12-5 kilograms. Under these conditions the resin shall extrude at a maximum rate of 0.25 grams per ten (10) minutes. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions or other defects. The pipe shall be uniform in color, capacity, density, and other physical properties.

D. The size, the type of plastic pipe material, dimension ratio, commercial standards with which the pipe complies, the manufacturer's name and the National Sanitation Foundation (NSF) seal of approval, shall be conspicuously marked on the outside of the pipe at intervals of not more than five (5) feet.

2.05 FITTINGS

A. Ductile iron mechanical joint fittings shall conform to the requirements of ANSI/ AWWA C110 and C153. The fittings shall be of the lightest class conforming to the pressure rating of the pipe lines in which they are installed, in no case shall the fittings be lighter than class 200.

B. Fittings for galvanized steel pipe shall be malleable iron conforming to ANSI B16.3 except the nipples and couplings shall be the same material as the pipe. All fittings shall be hot-dip galvanized in accordance with ASTM A120.

C. The mechanical joint shall meet requirements of ANSI A21.11 and shall have the same pressure rating as the fitting of which it is a part.

D. Fittings shall be coated inside and out with one mil. thick bituminous coating conforming to ASNI A21.4.

2.06 HYDRANTS

A. All fire hydrants shall conform to AWWA C502.

B. All fire hydrants shall have a 6" mechanical joint inlet connection and be equipped with a 5-1/4 inch valve, two 2-1/2 inch hose nozzles and one 4-1/2 inch pumper connection, all with ANSI (National) standard threads. Operating nuts shall be 1-1/2 inch, pentagon type.

C. All fire hydrants shall be equipped with "O" ring type stem seals.

D. All fire hydrants shall be designed for 150 psi working pressure and 300 psi test pressure.

E. All fire hydrants shall be equipped with a 6" gate valve, complying with other sections of the specifications, installed on the fire hydrant lead between the hydrant and the main.

F. The Contractor shall paint the hydrant with XO-14 Tractor Red (Federal Safety Color) paint.

G. All fire hydrants shall be designed such that clockwise rotation of the stem closes the valve and counterclockwise rotation opens the valve. Hydrant covers shall have the word "Open" and an arrow showing the proper rotation of the operating nut cast in or permanently attached.

H. An independent drain shall be provided, completely draining the hydrant after use. The drain shall be activated to the open position by the closing of the hydrant valve. The drain rod shall be easily cleaned. The drain shall have a protective shield integral with the hydrant base to minimize clogging and prevent undermining.

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I. All working parts of the hydrant shall be easily removed for inspection or servicing without digging or the use of hoists or derricks or special tools. The hydrant cover and stand pipe shall be removable without requiring the water to be shut off.

J. Each fire hydrant shall be equipped with a ground line mounted breakaway flange and cast iron safety stem coupling specially designed so that upon sustaining severe impact the hydrant will shear off at the ground line without loss of water in the main.

K. All fire hydrants shall be Mueller, M&H, Clow standard or equal as approved by the Engineer.

2.07 METERS

A. Contractor shall be responsible for making application and payment to City of Sylvester Utilities Department for new 6” water meter. Meter will be provided by City of Sylvester.

2.08 METER BOXES

A. The meter box shall be the approved standard product used by the water system owner and operator.

B. They shall be rectangular and of adequate dimension to accommodate the specified meters.

C. Boxes shall have cast iron or polyethylene covers labeled "WATER METER".

D. Boxes for 5/8" by 3/4" meters shall have inside width not less than 10 inches, inside length not less than 15 inches and overall height not less than 12 inches.

E. Boxes shall be designed and built to withstand traffic loads typical of yard installations.

2.09 VALVES

A. All valves 2" in diameter and smaller shall be constructed of brass or bronze except that the hand wheel which shall be of malleable iron construction with screwed ends. All valves 2-1/2" in diameter and larger shall have flanged ends for interior service and mechanical joints for buried service unless otherwise approved. They shall be iron body, bronze mounted, except that in the smaller sizes the valves may be all bronze.

B. Gate Valves:

1. Gate valves smaller than three inches shall meet the requirements of Fed. Spec. WW-V-54, Class A, 125 pounds.

2. Gate valves three inches and larger shall have nonrising stems and shall meet the requirements of AWWA Standard C-500. Valves for lighter pressures than the AWWA Standard shall meet the requirements of the above specifications except that the requirements for metal thickness and strengths and structural designs shall be adjusted as required to meet hydrostatic test pressures not less than 150 psi.

3. All gate valves shall have standard stuffing box seals. Bonnet bolts, studs and nuts shall be cadmium plated. Seating devices shall be bronze to iron or bronze to bronze. The glands shall be bronze or bronze bushed. Gland bolts and nuts shall be bronze.

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4. All gate valves shall be of the double disc or wedge type. The wedge or disc shall be totally encapsulated in rubber. The sealing rubber shall be permanently bonded to the wedge or disc to meet ASTM tests fro rubber metal bond ASTM D249.

5. Valves to have two inches square operating nut, with the exception that gate valves in altitude valves pits shall have hand wheels.

6. Valves buried in ground or located in vaults or structures shall have suitable extensions for socket operation with top of operating nut located two feet below finished grade maximum.

7. Any valve installed in a vault readily accessible for entry shall be equipped with handle wheels in lieu of operating nuts. No hand wheels are allowed in buried valves.

C. Check Valves:

1. Check valves 2" through 24" shall be iron body, bronze mounted swing check valves meeting the requirements of AWWA Standard C508-76.

2. The check valve shall be metal to metal or composite to metal seat construction with flange ends or screw and coupled ends.

D. Altitude Valves:

1. All altitude valves furnished for use in the systems shall be equipped for showing at all times the position of the valve. Said altitude valves shall be of the size specified on the drawings and suitable for the use intended.

2. The Contractor shall supply the services of a qualified manufacturer's representative to check and calibrate each altitude valve installation for proper working pressure and sequence.

E. Air Release Valves

1. Air release valve shall have all bronze body and bonnet. They shall be the direct acting type.

2. Valves shall be hydrostatically tested to at least 150 psi.

3. The valve shall have stainless steel floats and an internal coating with rust inhibitors.

2.10 BACKFLOW PREVENTERS

A. The backflow preventers used shall be those specifically designed for use in connections when the danger from backflow presents a health hazard.

B. All backflow preventers shall be of the reduced pressure type.

C. Backflow preventers 3/4" to 2" shall be Hersey, Model FRPII or equal meeting or exceeding the following specifications:

Mainline Case - Bronze

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Working Parts - Bronze & Stainless Steel
Springs - Stainless Steel
Diaphragms - Buna N and Mylar
Valve disc - Silicone Rubber
O Ring - Buna N
Check Valve Enclosure - Glass Reinforced Plastic
Maximum Rated Working Pressure - 150 psi
Temp. Range - 33° - 210°F

D. Backflow Preventers 2½" to 10" shall be Model 6CM or equal meeting or exceeding the following specifications:

Body 8"-10"- Hot Dipped Galvanized or Epoxy Coating
Body 2½"-6" - Bronze
Working Parts - Bronze & Stainless Steel
Springs 2½"-6"- Stainless Steel
Springs 8"-10"- Vinyl Coated Carbon Steel
Diaphragms - Reinforced Elastomer
Valve Disc - Silicone Rubber
Maximum Rated Working Pressure - 175 psi
Temp. Range - 33° - 140°F

E. Backflow preventers larger than 10" shall be designed for conditions that do present a health hazard. It shall be the reduced pressure type and depending on the application, may require detection of leaks or unauthorized use. Detectors above 10" shall be submitted for approval. The submittal shall include complete shop drawings. The submittal will be reviewed based on the product's ability to meet the needs of the project and the Owner.

PART 3 - EXECUTION

A. All valves shall be carefully mounted in their respective positions free from distortion and strain. All valves shall be properly packed and left in satisfactory operating condition at the completion of the project.

B. Valve box, cover and concrete pad shall be installed with each valve as shown in miscellaneous details.

3.01 PIPE INSTALLATION

A. PVC pipe shall be installed in accordance with the Uni-Bell Plastic Pipe Association guide for installation of polyvinyl chloride plastic pressure pipe for municipal water main distribution system and the printed recommendations of the manufacturer.

B. Ductile iron pipe shall be installed in accordance with AWWA C600.

C. Pipe line alignment and gradient shall be straight, or shall follow true curves as near as practicable. Curvature in pipe lines, where required, shall be well within the allowable laying radius, horizontal and vertical.

D. Excavation, cleaning, laying, jointing and backfilling shall follow as closely as is possible so as to progress the work. In no case shall pipe be left in the trench overnight without completing the jointing. The completed pipe line shall not be left exposed in the trench unnecessarily, and the Contractor shall backfill and compact the trench as soon as is possible after laying and jointing is

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completed. Each day at the close of work, and at all times when laying is not in progress, the exposed end of the pipe line in the trench shall be closed with a head or barrier of wood or metal. If at any time it becomes necessary to cover the end of any uncompleted pipe line with backfill, the end of that pipe shall be closed with a mechanical joint plug.

E. The Contractor shall keep exposed ends of pipe properly plugged during laying to prevent dirt and other materials from entering the line, and shall also, before the system is accepted, thoroughly clean all lines.

F. Thrust Blocks (Reaction Blocking) shall be provided as specified AWWA C600. All exposed pipes, valves, hydrants, etc., shall be securely strapped and all ends and bends braced.

G. Other means of pipe restraining in addition to thrust blocking shall include "mega lug" utilization and all threads bolted through fittings in accordance with AWWA C600. Thrust blocking may not be eliminated with the use of joint restraint.

H. Mechanical joints shall be made only by experienced mechanics. Sockets and spigots shall be washed with soapy water before slipping gland and gasket over spigot. The spigot shall be inserted in the socket full depth. The gasket shall be brushed with soapy water, and pushed into position making sure the gasket is evenly seated in the socket. The gland shall then be properly positioned for compressing the gasket. All bolts and nuts shall be tightened with a torque wrench to a uniform, permanent tightness. Bolts shall be tightened alternately 180 degrees apart. Sockets, spigots, glands and bolts shall be kept clean and wet with soapy water until each joint is completed.

I. All water distribution mains shall have a minimum 36" of cover.

3.02 FIRE HYDRANT INSTALLATION

A. All fire hydrants shall have 36" minimum pipe cover provided for the branch supply line.

B. Each fire hydrant shall be set on a stable foundation at least 18 inches square and 6 inches thick and shall be blocked against the end of the trench with concrete and anchored.

C. Hydrant drainage shall be provided by installing around the hydrant at least 7 cubic feet of gravel or crushed stone below the top of the hydrant supply pipe.

D. The barrel of the fire hydrant shall be set plumb (perpendicular to the ground) with the lowest discharge outlet at least fifteen (15) inches high but no higher than 24 inches above finished grade. No fire hydrant shall be installed within 10 feet of any private driveway. Hydrants shall be located no closer than 5 feet of a curbing and no further than 12 feet of the curbing.

E. Immediately before installation of a hydrant, the following operations shall be performed:

1. The hydrant shall be thoroughly inspected.

2. The hydrant interior shall be thoroughly cleaned.

3. The hydrant shall be opened and closed to determine that all parts are in proper working order, with valves seating properly and the drain valve operating freely.

3.03 HYDROSTATIC TEST

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A. Upon completion of backfilling operations and not less than seven (7) days after the last concrete blocking anchor has been poured, the pipe system shall be subject to hydrostatic test.

B. The system shall be filled with water and all air expelled.

C. The Contractor shall pressurize the system to 150 pounds per square inch at the highest point in the system.

D. The test pressure shall be maintained for two hours.

E. If the pressure cannot be maintained, the cause shall be determined, corrected and test repeated until successful.

3.04 LEAKAGE TEST

A. Following the pressure test, the system shall be subject to a leakage test.

B. Leakage shall be defined as the quantity of water that must be supplied into the pipe to maintain the design working pressure after all air in the pipe line has been expelled and the pipe has been filled with water.

C. Leakage shall not exceed the quantity determined by the formula given below:

$$L = \frac{ND(\text{Square Root of } P)}{7400}$$

WHERE L = allowable leakage in gallon/hr.
N = number of joints in pipe line
D = nominal diameter of the pipe inches
P = average test pressure during leakage test in psig

C. If leakage exceeds the allowable rate, leaks shall be found and repaired and the test repeated until successful.

3.05 DISINFECTION

A. Water mains and accessories shall be disinfected in accordance with "Rules for Safe Drinking Water" as published by the Georgia Environmental Protection Division.

B. The mains shall be flushed intro the storm drainage system before disinfecting by maintaining a velocity of at least 2.5 feet per second for a period of ten minutes.

C. The continuous feed method may be used for any size main or system where satisfactory quantity and quality water is available. The tablet method shall not be acceptable.

D. Following disinfection of the water system, the system shall be flushed until chlorine concentration is less than 1 milligram per liter. Flushing shall not allow chlorinated water to be discharged into the storm sewer system without first allowing the chlorine in the system to dissipate. The contractor Shall use a Pollard Water LPD-250 or equal equipment along with LPD-Chlor tablets (Sodium Sulfate or Ascorbic Acid) to de-chlorinate the water using 1 tablet per 2000 gallons of water minimum prior to flushing, then after adequate testing, discharge the de-chlorinated water to

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the storm sewer system or onto the land surface. During the de-chlorination flushing the flow through the LPD 250 will be maintained at between 200 and 1200 GPM. No flows for de-chlorination or flushing will not be allowed outside this flow specification. The contractor may apply to the owner of the sanitary sewer system to obtain permission to discharge the chlorinated water into the sanitary sewer system for a fee. The contractor shall be charged at the going rate per gallon for treating the water discharged to the sanitary sewer system.

E. Bacteriologic Tests:

1. Tests shall be performed to detect the presence of coliform organisms on samples taken from the end farthest from the point at which chlorine was introduced into the system and at 1000 ft. intervals.

2. The bacteriolical sample shall meet the requirements established by EPD for suitable disinfection for human consumption.

3. If unsatisfactory samples are produced, disinfection shall be repeated until samples are satisfactory.

END.

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SECTION 333110
SANITARY SEWERS

PART 1 - GENERAL

1.01 APPLICABLE STANDARDS

A. American National Standards Institute (ANSI):

A21.4	Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water
A21.6	Cast-Iron Pipe Centrifugally Cast in Metal Molds, for Water or Other Liquids
A21.11	Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings
A21.51	Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

B. American Society of Testing and Materials (ASTM):

A48	Gray Iron Castings
C12	Installing Vitrified Clay Sewer Pipe
C425	Compression Joints for Vitrified Clay Bell and Spigot Pipe
C478	Precast Reinforced Concrete Manhole Sections
C594	Compression Couplings for Vitrified Clay Plain-End Pipe
C700	Extra Strength and Standard Strength Clay and Perforated Clay Pipe
D1784	Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds
D2241	Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR and Class T)
D2321	Underground Installation of Flexible Thermoplastic Sewer Pipe
D2774	Underground Installation of Thermo-plastic Pressure Piping
D3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
D3139	Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals
D3212	Sewer Pipe Joints using Elastomeric Seals

C. American Water Works Association (AWWA):

C-600	Installation of Cast-Iron Mains

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1.02 SUBMITTALS

A. Materials used in the sanitary sewer system shall be submitted for approval to the Design Engineer. The Design Engineer shall review the drawings, provide a list of materials and certify compliance to the Owner.

B. Six copies of shop drawings or manufacturer's standard drawings or catalog cuts shall be submitted for the following:

1. Precast concrete manholes

2. Manholes and Frames

3. Gaskets - One of each type

4. Pipe - One of each type

5. Valves - One of each type

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall be responsible for handling and storage of all materials and damaged materials shall not be used in the work. Materials delivered to the site shall be promptly inspected for damage upon arrival. Damaged or defective materials to be immediately removed from the site.

B. All materials to be stored at least 12 inches above grade. Inside of pipes and fittings shall be kept free of dirt and debris. Rubber gaskets and plastic pipe not used immediately shall be protected from direct sunlight. Manhole units shall be handled with care to avoid chippage or breakage.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE AND FITTINGS

A. Polyvinyl chloride pipe and fittings for gravity sewers shall be SDR-35 for less than 12’ bury and SDR – 26 for 12’ bury and over, meeting ASTM D3034 for type PSM Polyvinyl Chloride (PVC) sewer pipe. The joints shall be Push-On "O" ring gasket type with integral bell and spigot meeting ASTM 3212. Threaded or solvent welded type joints shall not be used.

B Polyvinyl chloride pressure pipe shall meet one of the following specifications:

1. IPS Size PVC Pipe: Class 200 SDR 21 - Polyvinyl chloride water main pipe shall conform to Designation ASTM D2241 and shall consist of Type I, Grade 1 PVC compound conforming to ASTM D1784. All pipe shall be Class 200, SDR 21. The standard laying length shall be 20 ft. ±1 inch.

2. DIP Size PVC Pipe: AWWA C-900-07

a. C-900 polyvinyl chloride water main pipe 4” TO 12” shall conform to Designation ASTM D2241 and shall consist of Type I, Grade 1 PVC compound conforming to ASTM D1784. All pipe larger than 4” to 12” shall meet the requirements of AWWA C900, “Poly Vinyl Chloride (PVC) pressure pipe.” All pipe shall be class 235 pipe and shall meet the requirements of DR18. The standard laying length shall be 20 ft. ±1 inch.

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b. C-905 polyvinyl chloride water main pipe 14" to 30" shall be manufactured from compounds conforming to PVC cell classification of 12454B as defined in ASTM D-1784. The integral bell joint system meets the requirements of ASTM D-3139 and utilizes an elastomeric seal conforming to ASTM F-477. All pipe shall be class 200 pipe and shall meet the requirements of DR18. The standard laying length shall be 20 ft. ±1 inch.

c. When DIP size PVC pipe is used two 2" PVC pipe shall be SDR 21, 200 PSI pressure class, iron pipe.

C. Marking: Pipe shall be clearly marked with:

1. Manufacturer's Identification

2. Nominal Pipe Size

3. Material, Type and Grade

4. SDR or Pressure Rating

5. All gravity sewer pipe shall be green. Force main pipe shall be white or brown.

6. All pipe regardless of color shall be clearly marked **"SEWAGE FORCE MAIN"** or **"GRAVITY SEWER"** as appropriate, marked every three feet.

2.02 DUCTILE IRON PIPE AND FITTING

A. Type: Coated Ductile

B. Joints:

1. Push on type in accordance with ANSI A21.11.

2. Mechanical joint in accordance with ANSI A21.11 and fittings may be in accordance with A21.53..

C. Ductile iron pipe shall conform to ANSI A21.51.

D. Pipe shall have a Protecto 401 lining or equal. The lining should have a high resistance to fatty oils, detergents and sewage generated hydrogen sulfide.

E. Pipe shall be coated outside with one mil. thick bituminous coating conforming to ANSI A21.4 and AWWA C110, C115OR C151.

2.03 REINFORCED CONCRETE PIPE AND MANHOLES (WET WELLS OR VALVE PITS)

A. Precast concrete sections to be manufactured in accordance with provisions of ASTM C478. As a minimum, the interior of all sections shall be coated with two coats of bituminous coating. The first coat shall be spray applied and the second coat should be roller applied. In addition, in extremely corrosive environments, to include force main receiving manholes, wetwells, and the first two manhole from the force main connection shall be lined with sealed HDPE sheet liner. The HDPE

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liner shall have a watertight seal at all joints and penetrations. The liner shall be Agru Sure Grip Liner or equivalent.

B. Precast concrete riser sections to be 48 inches in diameter with minimum wall thickness of 4 inches.

C. Precast concrete base units to have minimum wall thickness of 5 inches.

D. Jointing material shall be rubber gasket type conforming to ASTM C443 or vulcanized butyl rubber base flexible joint sealer in rope form conforming to Federal Specification SS-S-00210, Kent-Seal No. 2 or approved equal. The inside and outside of the joint shall be finished with mortar. Mortar shall be one part Portland cement and two parts sand.

E. Manhole base sections shall provide for a flexible watertight union between pipe and manhole base. Manhole sleeves shall be of high quality synthetic rubber with tensile strength of 1,500 psi, resistant to raw sewage, ozone, acids, and weathering, flexible at temperatures below 0°F and resistant to heat as high as 250°F. A substantial, serrated flange of the sleeve material shall be integrally cast into the wall of the manhole base forming a tight waterseal. The sleeve shall protrude through the wall of the base. A watertight union shall be secured with the end of the pipe with stainless steel strap clamps. Manhole sleeves shall be Interpace Corp. Lock Joint Manhole Sleeves or approved equal.

F. Pick up holes shall not penetrate the interior walls or the riser.

2.04 MANHOLE FRAMES AND COVERS

A. Frames and covers to have machined bearing surfaces.

B. Covers to have checkered top design and marked "Sanitary Sewer" and include the name of the utility owner.

C. Combined weight of frame and cover shall be approximately 450 pounds.

D. Frame shall have a depth of approximately 9 inches and an access opening of not less than 20 inches.

E. Covers shall have two pick holes located at edges.

F. Materials shall conform to ASTM A48 for Class 30 gray iron castings.

2.05 MANHOLE STEPS

A. Manhole steps shall be constructed of a number 3 reinforcing bar encapsulated in polypropylene plastic with a non-skid tread.

B. Finished dimensions of the steps shall be identical to that of malleable iron manhole steps.

C. Steps to have a minimum tread width of 12 inches.

2.06 NUTS AND BOLTS

A. Stainless Steel Flanged: Square head MB/SF, hexagon nuts; ASTM 307B; ANSI B18.2, zinc plated.

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2.07 GASKETS

A. Flanged pipe gaskets shall conform to requirements of ASA A21.10 and shall be suitable for the indicated services.

2.08 VALVES

A. All valves two inches in diameter and smaller shall be constructed of brass or bronze except the hand wheel, which shall be of malleable iron construction. Valves two inches in diameter and smaller shall have screwed ends unless approved otherwise. All valves 2½ inches in diameter and larger shall have flanged ends unless otherwise approved. They shall be iron body, bronze mounted, except that in the smaller sizes the valves may be all bronze at the contractors option and expense.

B. The contractor shall prepare and submit for approval complete detailed drawings of all valves in accordance with the requirements of the appropriate section of these specifications. All valves of the same type shall be from a single manufacturer. Parts of valves of the same type and size shall be interchangeable. Spare parts shall be furnished as specified under the proposal items. Special tools required for repacking or disassembling valves shall be provided.

C. All valves shall be carefully mounted in their respective positions free from all distortion and strain. All valves shall be properly packed and left in satisfactory operating condition at the completion of the project. All valves shall open left.

D. Gate Valves

1. Gate valves should not be used in raw sewage applications. Gate valves should only be used where primary and partial secondary treatment has already occurred.

2. Unless otherwise specified or directed, gate valves three inches and larger shall have non-rising stems and shall meet the requirements of AWWA Standard C-500. Valves for lighter pressures than the AWWA Standard shall meet the requirements of the above specifications except that the requirements for metal thicknesses and strengths and structural designs shall be adjusted as required to meet hydrostatic test pressures not less than 125 psi.

3. Unless otherwise specified or directed, gate valves smaller than three inches shall meet the requirements of Federal Specification WW-V-54, Class A, 125 pounds.

4. All gate valves shall have standard stuffing box seals. Bonnet bolts, studs and nuts shall be cadmium plated. Seating devices shall be bronze to iron or bronze to bronze as specified or required. The glands shall be bronze or bronze bushed. Gland bolts and nuts shall be bronze.

5. All gate valves 2½ inches in diameter and larger shall be of the double disk type. All gate valves two inches in diameter and smaller may be of the double disk or the solid wedge type.

E. Plug Valves

1. All plug valves shall be the two-way type.

2. Nonlubricated, eccentric with resilient faced plugs.

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3. Port area of 4 to 20 inch valves shall be at least 70 percent of full pipe area.

4. Valves to be designed for 125 psi working pressure.

5. Bodies to be semisteel with raised seats.

6. Seats to have either a welded-in overlay of approximately 90 percent pure nickel on surfaces contacting the plug face or shall be bronze conforming to ASTM B-62 and attached to the body by stainless steel set screws.

7. Upper and lower plug stem bushings to be stainless steel and shall be permanently lubricated.

8. Exposed nuts, bolts and washers to be zinc plated.

9. Flanges to be faced and drilled to ASA 125 pound standard.

F. Check Valves

1. Type: Ball Check

a. Static head must exceed 10 feet to use ball check valves.

b. No ball check valve will be mounted vertically to compensate for low static head.

c. Ball check ends must be flanged.

d. The body shall be cast iron, ASTM A159-72, Class 35.

e. The ball shall be hollow steel with vulcanized nitrile rubber covering.

f. Pressure rating shall be 150 psi.

g. Valve to be Flygt HDL or equal.

2. Lever Actuate Spring Check Valve

a. Where static head is less than 10 feet lever action swing check valves shall be used.

b. Lever action swing checks may be spring and lever type or weight on lever type as approved by the design engineer and the Owner.

c. Valves shall be installed in the horizontal position.

d. The valve body, disc, cover and lever shall be cast iron, ASTM A159-72, Class 35.

e. The disc arm shall be cast steel

f. The seat ring shall be bronze or stainless steel.

g. All studs, bolts or nuts shall be commercial grade steel.

h. The gate shall be rubber faced.

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i. The hinge shaft shall be stainless steel.

j. The chamber shall be bronze.

k. The valve shall be Clow F5340 (outside spring and lever) or Clow F5345 (outside weight and lever) or an approved equal.

G. Automatic Sewage Air Release Valve

1. The automatic sewage air release valve shall be designed to allow entrapped air to escape from the sewage force main line. After the air escapes out of the air release valve, the valve shall shut-off until more air accumulates in it and the opening cycle will repeat automatically.

2. The sewage release valve must have a compound internal linkage of precision molded delfin or stainless steel. All other internals must be stainless steel to positively prevent galvanic action. The float rod shall be 20" long to provide an air gap between the linkage and waste level inside the valve to retard the waste solids from clogging the linkage. The stainless steel float must withstand a minimum 1000 psi pressure. Each valve shall be complete with hose and blow off valves to permit back flushing without dismantling valve.

Body and cover cast iron	ASTM A48 Class 30
Internal Delfin linkage	ASTMD2133 (or Stainless Steel)
Stainless Float	ASTM A240
Buna-N	ASTM SB800

3. Typical installation will utilize standard body valve. Valve height 28"-with back flushing attachments-33-1/2". If depth of trench is not deep enough, furnish short valve. Valve height 17-1/2" -with back flushing attachments-23-1/2".

4. Automatic sewage air release valve to be as manufactured by Crispin, Val-matic, or APCO equal to APCO Series 400 with accessories.

2.09 ACCESSORIES, PLUG, AND GATE VALVES

A. Valves to have two inch square operating nut unless otherwise indicated.

B. Valves buried in ground or located in vaults or structures to have suitable extensions for socket operation with top of operating nut located two feet below finished grades maximum.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Plastic piping installation shall be in accordance with ASTM D2321 Recommended Practice for non-pressure pipe and ASTM D2774 Recommended Practice for pressure pipe.

B. Ductile iron pressure piping shall be installed in accordance with AWWA Standard C600.

C. Material selection for piping material shall be as indicated. If piping materials are not indicated the Contractor has the option of selecting materials in accordance with this section.

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D. Service sewer lines shall be constructed of same material as the mains.

E. Sewer lines shall not be laid closer than 10 feet horizontally to a water main. Pressure sewer lines shall pass beneath water lines, with the top of the sewer being at least 18 inches below the bottom of the water line. Where sanitary sewer lines pass beneath water lines, no joints in the sewer line shall be closer than 10 feet, horizontal the water line. When the vertical or horizontal separation cannot be accomplished, then concrete encasement shall extend a minimum of 10 feet on both sides of crossing.

F. Pipe laying to proceed up-grade with pipe bells or groove on the upper end. Pipe to be laid with joints close and even, butting all around. Sagging joints will not be tolerated.

G. Pipe shall be straight and of uniform grade between manholes, laid to line and grade.

H. All sewer shall be designed and constructed to give velocities of not less than 2.0 FPS. Since the Owner has adopted a low flow plumbing device ordinance, the following slopes will be used.

Sewer Size	Minimum Slope in Feet Per 100 Feet
8"	0.44
10"	0.30
12"	0.24
15"	0.15
18"	0.12
21"	0.10
24"	0.08
30"	0.058
36"	0.046

I. An allowable deviation from the design grades will be allowed up to 5% of the grade shown on the plan. If the grade is steeper than allowed 5% deviation the engineer must verify that the project was installed to all minimum requirements and determine the impact of the additional grade. If the grade is flatter than the 5% deviation, then it exceeds the allowable tolerance and the installation of that line is not acceptable and must be replaced. All sewer mains installed will be field checked for grades during preparation of “Record drawings”.

J. Bell holes shall be dug so the pipe barrel will carry the load of the pipe. Pipe shall be bedded in undisturbed earth or, where rock occurs, on a thoroughly compacted layer of #57 stone or sand fill of a minimum thickness of 6 inches under the barrel or bell of the pipe.

K. Where sewers or force mains are to be connected to existing manholes or other structures, and where no stub or opening has been provided for the connection, the Contractor shall make an opening of minimum diameter through the side wall of the structure utilizing a professional coring machine and installing a boot for inserting the sewer pipe. The boot and stainless steel strap shall be sized and installed to create a water tight seal.

L. Lateral connection made to the sewer prior to back-filling shall be laid on a slope not exceeding 2 feet vertical to 1 foot horizontal, and not less than 1/8 inch per foot, so that the lateral shall have a solid bearing on undisturbed earth as stipulated for pipe sewers. The lateral shall make such a horizontal angle with the sewer line that a proper connection with the wye or tee branch or slant is

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obtained without trimming the pipe and with no danger of jointing material being forced into the sewer. All laterals shall be closed by means of suitable stoppers or end caps.

M. Wye or tee branches shall be field located for service to all subdivided lots or inhabitable structures unless otherwise directed by the Architect/Engineer. Wye branches shall be installed so that the lower lip of the branch is not more than 2 inches below the outside top of the pipe. Tees shall be installed with the branch 45° to vertical. After installation, wye or tee branches shall not be covered with backfill until determination and record has been made of the locations of each with reference to the nearest manhole downstream and the direction in which the wye faces.

N. All laterals shall be properly marked on ground surface at the point where laterals terminate with treated timber markers. Timber markers shall consist of a 2 inch by 4 inch timber extending from the end of the lateral vertically to within 2 inches of the ground surface. All such markers shall be securely anchored and maintained in a proper vertical position until backfilling has been completed. The top end of such markers shall be marked or left exposed until an "as-built" survey has been made.

O. The top rim of manhole frames and covers shall be set to conform to grades and transverse slopes. Generally along outfall lines, the manhole frames and covers shall extend approximately 6 inches above finished grade or to a designated elevation for flood protection. Generally where lines are located along streets, the manhole frames and covers shall be set flush with the surface.

P. The Contractor shall install a continuous run of plasticized metallic tape above the top of the sewer main at 12 inches to 18 inches below finished grade. Tape shall be suitable for detection with metal pipe location equipment labeled "sewer buried below," and brightly colored to contrast with the soil.

Q. A 14 gauge copper tracer wire with underground coating shall be installed along the route of pressure sewers. The wire shall be located 12 inches above the pipe but no deeper than 48 inches.

R. All PVC pressure pipe shall have a minimum of 36" cover. Areas where the cover is not maintained may require the use of extra strength (D.I.) pipe as directed by the engineer.

S. All sewer mains will be installed at a constant grade and line as shown on the plans. If after video inspection “sags” are found in the line, then the depth of the sag will be determined by the utility owner. If the sag is determined to be deeper than the following chart then the line will be removed and replaced to meet the minimum requirements of these specifications.

Pipe Size	Max. Sag Depth
8”	0.50”
10”	0.50”
12”	0.75”
15”	0.75”
18”	0.75”

3.02 PRESSURE TESTS

A. FORCE MAINS: The Contractor shall test by hydrostatic pressure to 150 pounds per square inch. Each section tested shall be slowly filled with water, care being taken to expel all air from the pipes. The required pressure shall be applied for not less than two hours. No pipe installation will be accepted until the leakage during the pressure test is less than the number of gallons listed below for each 1000 feet of pipe.

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6" - 1.5 gallons	12" - 2.75 gallons
8" - 1.75 gallons	14" - 3.00 gallons
10" - 2.75 gallons	16" - 3.5 gallons

B. GRAVITY MAINS: On All sewer mains less than 8' deep, the Contractor shall pressure test the gravity mains with air. Each section including manholes shall be pressurized to 3.5 psi. The allowable pressure drop of 0.5 psi on any portion of the system shall not be less than the times shown on the following chart.

PIPE SIZE	MINIMUM TIME
4"	3 MIN.
6"	4 MIN.
8"	6 MIN.
10"	7 MIN.
12"	8 MIN.

If the main will not maintain the specified pressure, the Contractor will isolate the weak joint and repair. The test will be repeated until successful. The service lines must be installed at least to the back of the curb prior to testing. These pressure drops represent a maximum infiltration/exfiltration rate of 25 gallons per inch of pipe diameter per mile per 24 hour period.

3.03 ALLOWABLE INFILTRATION/EXFILTRATION

A. If any visible flow is observed in the pipe during installation or final inspection a weir test will be conducted.

B. The leakage inward or outward (infiltration or exfiltration) of the entire system including the sewer mains, service sewers, manholes and wet wells shall not exceed 25 gallons per inch of pipe diameter per mile per day for any section of the system.

C. The weir shall be installed in each manhole. The manhole will then be filled with water to a depth of 3' from the top of the pipe, which should be at the bottom of the weir. The water level will stand for one (1) hour to stabilize then filled (if necessary) to the initial level. During the next hour the water level will be observed and the amount flowing through the weir or the amount of water required to maintain the level will be measured. This measured amount should not exceed the allowable.

3.04 INSPECTION

A. Upon complete installation of the gravity sewer, the Contractor must enter a waiting period of not less than 10 days prior to inspection. In order to initiate the waiting period, the Contractor must notify the Design Engineer and the Owner's inspector in writing of the status of the sewer.

B. After completion of the waiting period all sewer mains must pass a 5% deflection mandrel pulled by hand. If a 5% deflection mandrel will not pass through any section, that section will be replaced or rerounded at the expense of the Contractor. Mandrel to be supplied by the Owner's inspector, or by the Contractor if requested by the Owner.

C. Once the mandrel and physical inspection is complete the contractor will schedule a time when the owner may internally inspect the sewer main utilizing a sewer camera and generating a video inspection of the system. If any defects are found in the system as a result of the internal

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inspection then, that section of the sewer main and any mains feeding into that system will not be accepted.

D. No sewer main will be accepted if there is any evidence of sagging or bowing in the line which will adversely affect the performance of the pipe. Nor will any sewer mains be accepted if they are laid on a grade substantially less that specified on the Construction Plans. No line will be accepted if laid on less grade than the minimum stated in this specification.

E. All manholes will be inspected for general appearance, cracks, leaks, proper installation of frame and cover, steps and inverts. Any manholes, which do not conform to the specifications, will not be accepted until the deficiency is corrected by the Contractor.

F. All 4" sewer services will be tested for continuity and minimum bends by passing a standard tennis ball. Each sewer service shall be temporarily capped during construction. During the inspection, a tennis ball will be dropped down the open end of the sewer service. If the ball does not appear in the lower manhole the contractor will excavate the service, correct the blockage and repeat the test until successful.

G. All manhole and wetwell liner systems shall be tested using the “Spark Test” to locate incomplete welds or penetrations in the liner not adequately sealed for gas containment.

3.05 CLEANING

A. Contractor to clean the completed system of any debris or obstructions prior to Final Inspection.

END.

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SECTION 334210
STORM DRAINAGE AND APPURTENANCES

PART 1 - GENERAL

1.01 APPLICABLE STANDARDS

A. Appurtenances shall be constructed in accordance with the referenced Georgia Department of Transportation Standard Drawings.

B. American Society for Testing and Materials (ASTM):

C- 32 Specification for Sewer and Manhole Brick.

C- 76 Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

C-144 Aggregate for Masonry Mortar.

C-270 Mortar for Unit Masonry

C-443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

C-913 Specification for Precast Concrete Water and Wastewater Structures

C-536 Test for Continuity of Coatings in Glassed Steel Equipment by Electrical Testing.

C. Only reinforced concrete pipe will be allowed under roadways or frequently traveled areas.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Roadway Storm Drainage Pipe: Pipe shall be reinforced Concrete Pipe which conforms to ASTM Specification C-76 and shall be of sizes shown. Pipe shall be Class III minimum and as indicated on GA. D.O.T. Standard 1030 D.

B. Non Roadway Storm Drainage Pipe: Pipe shall be one of the following:

1. Polyvinyl chloride (PVC) pipe shall be manufactured and tested in accordance with specification for "Poly (Vinyl Chloride) PVC Large Diameter Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter." The pipe and fittings shall be made of PVC plastic and shall have a smooth (not ribbed or corrugated) inside surface.

   All pipe shall be bell and spigot. The bell shall consist of an integral wall section or an internal plastic sleeve. The solid cross section rubber ring shall be factory assembled on the spigot. Size and dimensions shall be as shown on the plans. Standard laying length shall be 13 feet ±1 inch.

   All fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal and have bell and/or spigot configurations compatible with that of the pipe.

   Pipes shall be designed to pass all tests described herein at 73° F (± 3° F).

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The pipe stiffness shall equal or exceed 10 psi when tested in accordance with ASTM D 2412.

2. High density Polyethylene (HDPE) pipe shall be manufactured for use in nonpressure storm sewer. The pipe shall be manufactured to meet AASHTO M294, Type 'S' for 12" through 36" and AASHTO MP6-96, Type 'S' OR 'D' for 42" and 48" pipe. The pipe and fittings shall be made from HDPE material and shall have a smooth (not ribbed or corrugated) inside surface.

   a. All pipe shall be bell and spigot. The bell shall be an integral part of the pipe. The joint shall use a gasket to form a water tight connection meeting ASTM D3212. Gaskets shall be installed in the bell or in the spigot by the manufacturer.

   b. All fittings shall conform to AASHTO M294 or MP6-95. Fabricated fittings shall be welded on the interior and exterior at all junctions.

   c. Pipe and fittings material shall be high-density polyethylene meeting ASTM D3350.

   d. Installation shall be in accordance with ASTM D2321.

   e. Pipe may be Advanced Drainage System, Inc., N-12 or N-12 HC or Hancor Sure Lok 10-8 pipe.

   f. HDPE end sections are NOT allowed.

C. Pipe Joints:

1. Joints for concrete pipe shall be one of the following types:

   a. Bell and spigot with rubber gaskets.

   b. Tongue and groove with rubber gaskets.

   c. Tongue and groove with preformed plastic gaskets.

2. Rubber Gaskets shall conform to ASTM Specification C443. Only a neutral agent shall be used as a lubricant. Preformed Plastic Gaskets shall conform to Federal Specification SS-S210, Type I-rope form.

3. Joints for PVC pipe must be an integral bell gasketed joint which forms a water tight joint.

D. Precast Concrete Manhole Sections:

ASTM C913, except that spacing of manhole steps or ladder rungs shall not exceed 12 inches.

E. Masonry Manholes: Shall be constructed of the following materials:

1. Brick: ASTM C32, Grade MS

2. Mortar of Masonry: ASTM C279, Type M.

3. Aggregate for Masonry Mortar: ASTM C144.

4. Water for Masonry Mortar shall be fresh, clean and potable.

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F. METALS

1. Frames, Covers, and Grating: Frames, covers, and grating shall conform to AASHTO M-306-07 and shall be of grey iron castings.

2. Manhole Steps: Manhole steps shall be constructed of a number of 3 reinforcing bar encapsulated in polypropylene plastic with a non-skid tread. Finished dimensions of the steps shall be identical to that of malleable iron manhole steps. Steps to have a minimum tread width of 12 inches.

2.02 DELIVERY AND STORAGE

A. Storm Drainage Pipe: Care shall be exercised in loading and unloading pipe, fittings, specials and castings at all times in order to avoid shock and damage to the materials. Lifting shall be by hoist or by rolling on skids. Dropping will not be permitted. The Contractor shall be responsible for the safe handling of all materials and no damaged materials shall be used in the work. Materials shall be inspected upon arrival at the site, and any damaged or defective materials shall be immediately removed from the site. All materials shall be stored above grade.

B. Cementious Materials: Cementious materials in bags shall be stored in enclosed structures, floors shall be elevated above the ground a distance sufficient to prevent the absorption of moisture.

C. Metal Items: Metal items, including reinforcing steel, shall be stored above grade in a manner which will not cause excessive rusting or coating with grease or other objectionable materials.

D. PVC Pipe: PVC pipe shall be stored protected from sun light by means of covering the pipe or storing inside a building or under a covered shed. Any pipe showing signs of prolonged outside storage (i.e. faded exterior color or signs of drying) shall be rejected.

E. Aggregates: Aggregates shall be stored on areas to prevent the inclusion of foreign material. Aggregates of different sizes shall be stored in separate piles. Stockpiles of coarse aggregate shall be built in horizontal layers not exceeding 4 feet in depth to minimize segregation. Should the coarse aggregate become segregated, it shall be remixed to conform to the grading requirements.

F. Brick, Concrete Masonry Units and Precast Concrete Manholes: Brick, concrete masonry units and precast concrete manholes shall be handled with care to avoid chipping and breakage, and shall be stored to protect them from contact with the earth and exposure to the weather, and shall be kept dry until used. Masonry units or precast concrete containing frost or ice shall not be used.

PART 3 - EXECUTION

3.01 DRAINAGE PIPE

A. Each section of pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used.

B. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Pipe shall be laid true to line and grades indicated and shall rest upon the pipe bed for the full length of each section. Runs of pipe shall be laid with outside bells or grooved ends up-grade beginning at the lower end of the pipe line. Pipe having its grade and/or joint disturbed after laying shall be removed, cleaned, and relayed.

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C. When pipes are protected by head walls or connect with drainage structures, the exposed ends of the pipe shall be placed or cut flush with the inside face of the structure. After the pipe is cut the rough edges shall be smoothed up in an approved manner. All pipe shall be laid so that markings are on top and the inner surfaces abut neatly, tightly and smoothly.

D. All pipe in place shall be observed by the Engineer before being covered and concealed unless this requirement is waived by the City Inspector and the Design Engineer. **Contractor shall clear all pipe of silt debris prior to final acceptance.**

3.02 CONCRETE PIPE JOINT

A. Joint installation shall be in accordance with the recommendations of the manufacturer of the joint material. Surfaces to receive lubricants, cements or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust and other deletious agents at all times. Gaskets and jointing materials shall be inspected before installation of the pipe, and any loose or improperly affixed gaskets and jointing materials shall be removed and replaced.

B. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint, the gasket or jointing material becomes loose and can be seen through the exterior joint recess when the joint is pulled up to within one inch of closure, the pipe shall be removed and the joint remade.

3.03 MASONRY WORK

A. Mortar for Masonry: Mortar for brick masonry, rubble stone masonry, and for bedding cast iron frames in masonry shall be Type M, conforming to ASTM C270.

B. Mortar for pargetting Masonry Walls: Mortar for pargetting masonry walls below grade shall be Type M, conforming to ASTM C270.

C. Brickwork: Brick in circular walls shall be laid in all header courses to form full and close mortar joints, ends and sides in one operation. Vertical joints shall be radial from the center. Brickwork around pipe inlets and outlets shall not be allowed. Gaps shall be poured with concrete.

D. Masonry Structures: Masonry structure walls shall be constructed of brick, concrete masonry units or precast concrete structural sections.

3.04 PRECAST CONCRETE

A. Walls shall be constructed on a footing of cast-in-place concrete, except that precast concrete base sections may be used for precast concrete structure risers. Precast base sections shall conform to the applicable requirements for precast risers and tops in ASTM C913. Mortar that has hardened to the extent that it cannot be made workable without the addition of water shall not be used. Thickness of parget shall be not less than 1/2 inch. No pargetting will be permitted on the inside of structures. Pargetting will not be required for precast concrete structures. Joint work inside masonry structures shall be smooth.
B. One course of brick work is allowed for leveling and adjustment. All other adjustments must be poured in place concrete with a maximum height of 24 inches.
C. For single and double wing catch basins a concrete pad shall be poured 4 inches thick with a minimum slope of 1” per foot away from the curb and gutter and towards the box.

3.05 METAL WORK

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A. Iron and steel shall be formed to shape and size with sharp lines and angles. Shearing and punching shall produce clean true lines and surfaces. Casting shall be sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Exposed surfaces shall have a smooth finish and sharp well defined lines and arises. The necessary rivets, lugs, and brackets shall be provided.

3.06 FIELD TEST

A. A light held in a drainage structure shall show a practically full circle of light through the pipe when viewed from the adjoining end of the line.

B. Lines under pavements shall be tested for infiltration by means of a suitable weir or other measurement device as directed by the Owner. When determination of infiltration is not practicable because of dry trench conditions, an exfiltration test shall be applied by filling with water so that the hydraulic head will be at least 6 inches above the crown of the upper end and of the section being tested. The amount of leakage (infiltration or exfiltration) shall not exceed 100 gallons per inch of diameter per day per mile of pipe. Testing shall be the responsibility of the Contractor.

END.

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