SPECIFICATIONS FOR

INSTRUCTIONAL BUILDING

SISSETON WAHPETON COLLEGE

BIA RD 700
AGENCY VILLAGE, SD 57262

March 7, 2025

HKG ARCHITECTS, ABERDEEN, SD
PROJECT NO. 2023-0029
WEST PLAINS ENGINEERING, SIOUX FALLS, SD

ARCHITECT

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INSTRUCTIONAL BUILDING
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ADVERTISEMENT FOR BIDS

Sealed bids will be received by Sisseton Wahpeton College, BIA Road 700, Agency Village SD, 57262 until 1:00 P.M., C.T., April 15, 2025, for material and labor required for the Instructional Building Addition to Sisseton Wahpeton College.

All divisions of work will be included in one prime construction contract.

A Pre-Bid Walk through will be conducted on April 8, 2025 at 1:00pm.

Bids shall be submitted in a sealed envelope with the name and address of the bidder clearly identified on the envelope. Faxed bids will not be accepted.

Copies of the plans and specifications are on file at Sisseton Wahpeton College, Office of the President, Agency Village, SD; Builders Exchanges listed in the Instruction to Bidders; and at the office of HKG Architects, Inc., AIA, 524 S. Arch St., Aberdeen, South Dakota. Digital copies may be obtained from the architect by bidders.

Davis Bacon, TERO laws and Indian Preference wage rates do apply. Each bid must be accompanied by a 10% bid bond issued by a surety authorized to do business in the State of South Dakota and made payable to the "Sisseton Wahpeton College".

The Owner reserves the right to reject any or all bids and to waive any irregularities therein.

By order of
Sisseton Wahpeton College
Agency Village, SD

PROPOSAL
GENERAL, MECHANICAL & ELECTRICAL CONSTRUCTION

_____
FIRM

_____
ADDRESS

_____
DATE

NOTE: This proposal to be submitted in duplicate, on forms provided; in a sealed envelope, clearly marked as noted in Instructions to Bidders.

Instructional Building
Sisseton Wahpeton College
Agency Village, SD 57262

We hereby proposed to furnish all labor, materials, and equipment required for the Construction of the Nursing and Culinary Classroom Addition to Sisseton Wahpeton College, Agency Village, South Dakota; all to be in strict accordance with the plans and specifications prepared by HKG Architects, AIA for the following Base Bid:

BASE BID _____
Dollars ($).

_____

****

Alternate No. 1: Add – Exterior Canopy to Front of Existing Building _____

_____
Dollars ($).

_____
Contractor shall construct and install front exterior canopy in front of existing building as shown on drawings to be completed by August 1st, 2025

****

Alternate No.2: Add – 3'-0" Tall Thin Brick Wainscot at Windows Change Window Type_____

_____
Dollars ($).

_____
General Contractor shall install 3'-0" tall thin brick wainscot on exterior walls & change window A type to Type A Alt. #2 Windows

****

Alternate No.3: Add – Replace Hallway VCT with LVT. _____

_____
Dollars ($).

_____

****

TIME OF COMPLETION

Contractor to estimate completion date in days based on delievery of materials and speicality items.

_____ Days

GENERAL NOTES

Accompanying this proposal is a certified check, cashiers check or draft, or bid bond made payable to Sisseton Wahpeton College, BIA Road 700, Agency Village, South Dakota.
Before completing bid, contractors should contact the Tribal Tax Office with regards to any taxes that may apply such as 2% Excise Tax, 5.5% Use Tax and 3% TERO Tax.
In submitting this proposal, it is understood that the right is reserved by the owner to reject any and all bids and to waive all informalities.

The contractor hereby acknowledges receipt of the following Addenda:
(Give Number and Date of each) _____

FIRM _____

ADDRESS _____

BY _____

TITLE _____

PHONE _____ FAX _____

BID MODIFICATION FORM

DATE: _____

Instructional Building
Sisseton Wahpeton College
Agency Village, SD 57262

Please make the following modifications to our bid on the referenced project. This modification is per the Instructions to Bidders, Article 4.4 Modification or Withdrawal of Bid, included in the original bid documents and modifies our sealed bid.

DATE: Please circle the appropriate ADD/DEDUCT action.

Modification to Base Bid – ADD / DEDUCT to our Base Bid the Sum of

_____

Dollars ($_____)

Modification to Alternate #1 – ADD / DEDUCT to our Base Bid the Sum of

_____

Dollars ($_____)

Modification to Alternate #2 – ADD / DEDUCT to our Base Bid the Sum of

_____

Dollars ($_____)

Modification to Alternate #3 – ADD / DEDUCT to our Base Bid the Sum of

_____

Dollars ($_____)

GENERAL NOTES

In submitting this modification to the bid it is understood that the right is reserved by the owner to reject any and all bids and to waive all informalities. It is further understood by the Bidder that he may not withdraw his Bid within 30 days after the actual opening thereof.

The contractor hereby acknowledges receipt of the following Addenda:
(Give Number and Date of each) _____

FIRM

ADDRESS

BY

TITLE

PHONE FAX

E-MAIL ADDRESS

AIA® Document A701® – 2018

Instructions to Bidders

for the following Project:

Sisseton Wahpeton College
Instructional Building
HKG #2023-0020

THE OWNER:

Sisseton Wahpeton College
12572 BIA 700
Agency Village Box 689
Sisseton, SD 57262

THE ARCHITECT:

HKG Architects, Inc
524 S Arch Street
Aberdeen, SD 57401
(605)225-6820

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

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

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

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

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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, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Paragraph deleted)

Call (605)225-6820 or email request to Caitlin@hkgarchitects.com or Andy@hkgarchitects.com

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper

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documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

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

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

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

§ 3.2 Modification or Interpretation of Bidding Documents

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

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.
(Paragraph deleted)
Call (605)225-6820 or email request to Caitlin@hkgarchitects.com or Andy@hkgarchitects.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.

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§ 3.4 Addenda

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

By email and posted on the website

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

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

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

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

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

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

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

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

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

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

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:
(Paragraph deleted)
In the form and amount required if so stipulated in the Instructions to Bidders

§ 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.

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§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning thirty (30) days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

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

See section 4.3.2

§ 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:

Security will be returned 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,

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the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

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

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

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

§ 6.2 Owner's Financial Capability

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

§ 6.3 Submittals

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

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

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

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

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

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

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

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

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

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

(Paragraphs deleted)

§ 7.2 Time of Delivery and Form of Bonds

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

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

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

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

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

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

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

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

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

.4 Building Information Modeling Exhibit, if completed:

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages

.8 Other Exhibits:

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(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

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

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

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SUPPLEMENTS TO INSTRUCTIONS TO BIDDERS

AIA Document A-701-1997 "Instructions to Bidders" latest Edition shall pertain to this contract. The following information and supplements shall modify, change, delete or add to this document. Where any part of the Instructions to Bidders is modified or voided by the following articles, the unaltered provisions of that part shall remain in effect.

3.1.1. One set of Bidding Documents may be secured by prospective bidders from the office of the architect; deposit not required. This set of documents shall be promptly returned to the architect by all but the successful bidders. Bidders may secure additional copies of Bidding Documents upon payment of reproduction costs, not subject to refund.

3.1.2. Sub-bidders will be furnished Bidding Documents only if the party bears the reproduction costs, not subject to refund.

4.1.1. Bids shall be submitted in duplicate.

4.1.1.1. All divisions of the work to be included in one prime general construction contract.

4.2.1. Bid Security will be required on this project as specified in Advertisement for Bids.

4.3.1. Bids shall be submitted in sealed envelope plainly marked on face as follows:

Bidders Name
Bidders Address

Proposal For:	General, Mechanical & Electrical Construction
Project:	Instructional Building Addition to Sisseton Wahpeton College
Location:	Agency Village, South Dakota

4.3.2. Bids will be received as follows:

Date: April 15, 2025
Time: 2:00 P.M. C.T.
Location: Sisseton Wahpeton College
BIA Highway 700
Agency Village, South Dakota 57262

4.4.1 Bids may not be modified, withdrawn or cancelled for thirty (30) days following date for receipt of bids.

8.1. A copy of this agreement may be examined by bidders at the office of the architect.

EXAMINATION OF BIDDING DOCUMENTS:

Plans and specifications will be on file at the following places:

1. Office of the President, Sisseton Wahpeton College, Agency Village, South Dakota
2. Office of the Facilities Director, Sisseton Wahpeton College, Agency Village, South Dakota
3. Office of the Architect, Aberdeen, South Dakota
4. Office of the Engineers, Sioux Falls, South Dakota
5. Builders Exchanges in the following cities:
    a. Aberdeen, South Dakota
    b. Sioux Falls, South Dakota
    c. Bismarck, North Dakota
    d. Fargo, North Dakota
    e. McGraw-Hill Dodge Plan Room, Minneapolis, MN
    f. Reed Construction Data, Norcross, GA
    g. Rapid City, South Dakota

AIA® Document A201® – 2007

General Conditions of the Contract for Construction

for the following PROJECT:

Sisseton Wahpeton College
Instructional Building
HKG #2023-0020

THE OWNER:

Sisseton Wahpeton College
12572 BIA 700
Agency Village Box 689
Sisseton, SD 57262

THE ARCHITECT:

HKG Architects, Inc
524 S Arch Street
Aberdeen, SD 57401
(605)225-6820

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

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

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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 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 and certify termination of the Agreement under Section 14.2.2.

§ 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.

Init.
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§ 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 will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment 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 this 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 material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them 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 material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

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 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the

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portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 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.

§ 2.2.3 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.

§ 2.2.4 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.

§ 2.2.5 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.

§ 2.3 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.

§ 2.4 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 written 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 deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor 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. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

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 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.

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§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, 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 make 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 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, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and 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 written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required 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.

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

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

§ 3.5 WARRANTY

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.

§ 3.6 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 21 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 an equitable adjustment 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 in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed 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

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continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 ALLOWANCES

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 SUPERINTENDENT

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

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply 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 SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be 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, 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 maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required

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submittals. These shall be available to the Architect and shall be 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 the way by which 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 requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing 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 written 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. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop

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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, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, 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. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 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, and 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 and patching shall be restored to the condition existing prior to the cutting, fitting and 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 such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's 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 or 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 Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect 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 such 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 the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

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

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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 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.

§ 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.

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

§ 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, except as provided in Section 3.3.1.

§ 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 report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) 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 FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 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 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed.

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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, material and equipment 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, unless otherwise specifically stated by the Architect, 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 authorize 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 duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

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

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§ 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 or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply 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 previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, 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, which the Contractor, by these 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 in writing; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

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§ 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 such 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 Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 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 other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the 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, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor 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 report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report 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, except as to defects not then reasonably discoverable.

§ 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 the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

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

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§ 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, and the Contractor shall proceed promptly, 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 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 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.

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§ 7.3.6 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.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and 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 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.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 related to the Work; and

.5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 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 has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

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

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

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

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

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§ 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, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 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 an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order 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

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.

§ 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's 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. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

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

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material 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

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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, material suppliers, or other persons or entities making a claim by reason of having 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 issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part 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 comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. 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. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. 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 material 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 for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a separate contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents.

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

§ 9.5.3 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 material or equipment suppliers to whom the

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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 Architect will reflect such payment on the next Certificate 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 material and equipment 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 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, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment 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 and 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, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 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' written 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 shut-down, 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.

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§ 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, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall 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 such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such 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 as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

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

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

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written 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 and, 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 terms and conditions of 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 and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract

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Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, 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. If such lien 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 such lien, 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 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 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; or
- **.3** terms of special warranties required by the Contract Documents.

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

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

§ 10.2 SAFETY OF PERSONS AND PROPERTY

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

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; 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 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 owners and users of adjacent sites and utilities.

§ 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

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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, except damage or loss 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, written notice of such 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

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. 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 report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written 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 such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, 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 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 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.

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§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance 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 indemnify 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 LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- **.1** Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- **.2** Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- **.3** Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- **.4** Claims for damages insured by usual personal injury liability coverage;
- **.5** Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- **.6** Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- **.7** Claims for bodily injury or property damage arising out of completed operations; and
- **.8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents 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

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insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.2 OWNER'S LIABILITY INSURANCE

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

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

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§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 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, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 WAIVERS OF SUBROGATION

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, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, 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 covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance 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 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

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

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, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after 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 an 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 written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 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, whether completed or partially completed, of the Owner or separate contractors 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

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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 except that, 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 such 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 such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 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.

§ 13.4.2 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 there under, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 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 (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 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 13.5.1, 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 13.5.3, shall be at the Owner's expense.

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§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 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.

§ 13.5.4 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.

§ 13.5.5 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.

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

§ 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may 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.

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time 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 13.7.

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 or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, 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 promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

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

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor 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' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

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§ 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 for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- **.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 above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, 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' written 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 as described in 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 written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

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

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

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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, 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.

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written 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 must 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 CONTINUING CONTRACT PERFORMANCE

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. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

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

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

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

§ 15.1.5.2 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.

§ 15.1.6 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 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, 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 arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no 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.

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§ 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 such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

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

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

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, 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 15.1.6 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.

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§ 15.3.3 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. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

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

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

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

§ 15.4.4 CONSOLIDATION OR JOINDER

§ 15.4.4.1 Either party, at its sole discretion, 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 Either party, at its sole discretion, 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 the Owner and Contractor under this Agreement.

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SUPPLEMENTS TO GENERAL CONDITIONS

AIA Document A-201-2007 "General Conditions of the Contract for Construction", shall pertain to this contract. The following information and supplements shall modify, change, delete or add to this document. Where any part of the General Conditions is modified or voided by the following articles, the unaltered provisions of that part shall remain in effect.

ARTICLE 3 – CONTRACTOR"

Add the following:

3.10.4. Progress Schedule shall be submitted by general contractor in six copies within ten days after date of Notice to Proceed. Architect will distribute to each other prime contractor and owner.

3.12.5. Procedures for shop drawing submittals will be submitted via Submittal Exchange.

3.12.9.1. Each room, door, window and other items having numbers on the contract drawings shall be referred to by those numbers only and are not to be changed on shop drawings.

3.14.2. Add the following 3 paragraphs:

.1 Cutting and patching shall be kept to a minimum which will allow the proper placement of the materials. Unauthorized and/or careless cutting will not be tolerated. Each contractor shall be responsible for all cutting and making good thereafter as may be necessary for the performance of the work under this contract, or for the proper connection of work under the different sections of this contract. No such cutting shall impair the strength of any part of the building. Properly place in the slabs, walls, etc. during construction the necessary anchors, inserts, sleeves, and hangers, chase, etc., required for the installation of the materials.

.2 Cutting and patching required for plumbing, heating, ventilating and electrical work shall be done by the respective contractors. It if suggested that the contractors make their own arrangements with the general contractor to do all patching required in connection with their work. No cutting or drilling shall be done without the permission and instruction of the general contractor and the A/E. No cutting of structural members shall be done except as approved by the A/E.

.3 Workmen employed to do the patchwork shall be workmen skilled in the particular trade, or trades involved. The quality of the workmanship must be of the best and the work shall restore the structure and surfaces to new condition to match the existing adjoining work, using materials and methods consistent with the requirements for general contractor.

3.15.3. All glass shall be fully protected from damage of any kind. Do not allow mortar or any other substance to remain on glass. Just prior to final inspection, the general contractor shall replace any broken glass; clean all glass; remove stains, spots, marks or other dirt from his work; clean all walks and drives by washing and/or sweeping; remove all construction equipment and excess materials from site; clean hardware; remove all paint spots; clean all walls if necessary and clean all floors in accordance with the instructions of flooring sub-contractor.

ARTICLE 5 – SUBCONTRACTORS:

Add the following:

5.2.1.1. A complete list of subcontractors and material suppliers shall be submitted in three copies, within ten days after letting date.

ARTICLE 7 – CHANGES IN THE WORK:

Add the following:

7.2.1.4. Change orders will be prepared in three copies. Likewise, change order proposals shall be prepared in three copies and shall contain a complete breakdown of all costs and substantiating proposals from subcontractors if involved, shall be attached. Subcontractor proposals also to contain a complete breakdown.

7.2.1.5. Maximum allowance for overhead and profit on add or deduct change orders shall be 5% for overhead and 5% for profit. The cost of the Bond, Builders Risk, basic construction plant, home office, general superintendent and the like, shall be considered part of the overhead cost. Add or deduct control orders will be computed on the same basis.

ARTICLE 9 – PAYMENTS AND COMPLETION:

9.6.1. Add the following:

Progress payment retainage: The contract shall be so conditioned that it will provide for retention of not less than the following percentages: 5% of the amount of the contract until the contract shall be fully executed and completed to the satisfaction and acceptance of the owner.

9.10.2. The requirements of this paragraph must be met prior to issuance of final certificate for payment. The contractor will submit AIA Documents G706, G706A, and G707 to the architect to meet compliance.

ARTICLE 10: Add the following:

10.2.7. All parts of the work shall be braced to resist wind or other loads. The contractor shall perform the work with the explicit understanding that the design of the project is based on all parts of the work having been completed and as such, the methods of performance of each part of the work shall be done accordingly.

10.2.8. Temporary items such as, but not limited to:

Scaffolding, staging, lifting, and hoisting devices, shoring, excavation barricades, and safety and construction procedures necessary in completion of the project shall be the responsibility of the contractors and their subcontractors and shall comply with the applicable codes and regulations. OSHA Standards for the Construction

Industry (29CFR Part 1926) shall be complied with in every respect. It shall not be the responsibility of the owner or the architect to determine if the contractors, subcontractors, their representatives are in compliance with the aforementioned regulations.

ARTICLE 11- INSURANCE:

Add the following: Insurance to be furnished in accordance with the completed Accord 25-S Form and AIA Document G715 which follows this section. Architect will furnish to each prime contractor, copies of AIA Document G715 submitted in three copies along with Accord 25-S Form.

Requirement in General Conditions, AIA Document A201, Subparagraph 9.10.2 for Certificate evidencing continuation of products – completed operations insurance for at least one year after final payment is drawn to contractors attention.

11.4.1. The deductible amount provided by the standard vandalism and malicious mischief endorsement if any occurs will be paid by the owner.

END OF SECTION.

GENERAL REQUIREMENTS FOR Tribal Employment Rights Office & SWO TAX Office

Sisseton-Wahpeton Oyate Indian Preference Law Known as TERO Chapter 59

&

Business License Ordinance Chapter 53 and Tax Ordinance Chapter 67

GENERAL

In accordance with Chapter 59, Tribal Employment Rights Law, and Chapter 53, Business License Ordinance, there are certain requirements which SWO TERO and SWO Tax offices may impose regarding license fees, Use tax, Excise tax, TERO fee, wage rates, Indian contracting/subcontracting, Indian employment and Indian training. Strict compliance is expected and will be enforced pursuant to the procedures set forth in these laws. **Before completing a bid on a construction project on Tribal lands, you should contact the Tribal Tax Office in regards to any taxes that may apply.**

A. BUSINESS LICENSE FEE

1. Any Employer who wishes to engage in or transact business for the Sisseton-Wahpeton Oyate or its enterprises shall submit a completed application to the Tribal Tax Office for review and approval. Fees are $50.00 per year for tribal members and $100.00 for non-members. This fee is not pro-rated. No work shall begin until a business license has been issued by the Tax Revenue Office.

B. EXCISE TAX 2%

1. 67-02-02 Contractor's Excise Tax : There is imposed a Contractor's Excise Tax upon the gross receipts of all prime contractors and subcontractors engaged in realty improvement contacts within the jurisdiction of the Tribe, at the rate of two percent (2%).

C. USE TAX 5.5%

1. 67-03-02 For the privilege of using, storing, distributing or consuming within the jurisdiction of the Tribe tangible personal property, consisting of goods, wares, merchandise, propane, building materials and equipment purchased for use, storage, distribution or consumption within the jurisdiction, a use tax is imposed of 5.5% on the purchase price of the tangible personal property.

D. WAGE RATES

1. The Sisseton-Wahpeton Oyate has adopted a wage rate consistent with prevailing rates in this area for all construction occurring on our reservation. A copy of these rates are a part of these specifications.

E. INDIAN PREFERENCE IN CONTRACTING AND SUBCONTRACTING

1. Preference in awarding all contracts and subcontracts for supplies, services, labor and materials, will be given to qualified entities certified by the TERO Commission as 51%

or more Indian owned and controlled. A compliance plan must be submitted and approved by the TERO Office before any work can begin. The TERO Commission has established 70% as the minimum number of Indians each employer must employ aside from core crew employees.

F. INDIAN PREFERENCE IN EMPLOYMENT

1. All employers, for all employment occurring within our reservation or by its entities, are required to give preference to qualified Indians in all hiring, promotion, training and all other aspects of employment As established by Tribal Law, first preference shall be given to enrolled members of the Tribe, second to Indians who are married to enrolled members of the Tribe, and third, to local Indians. If Federal law supersedes these requirements, preference shall be given to any local Indian.

G. INDIAN TRAINING

1. Special emphasis shall be placed on recruiting and training Tribal members for every employment position. Employers may be required by the Commission to participate in training programs to assist Indians to become qualified in various job classifications.

H. TRIBAL JURISDICTION

1. All disputes arising out of the performance of the Work shall be submitted to binding arbitration pursuant to the rules and regulations of the American Arbitration Association. Enforcement of the arbitrator's award shall be had in the Sisseton-Wahpeton Oyate Tribal Court, which shall have exclusive jurisdiction. Any other dispute arising out of or related to this contract shall be heard in the Sisseton-Wahpeton Oyate Tribal Court, and said court shall have exclusive and original jurisdiction over all such claims. Further, Contractor consents to, and shall obtain the consent of its employees-, to the civil and criminal jurisdiction of the Tribe, however, the Tribe agrees that all non-Tribal members who consent to such criminal jurisdiction of the Tribe, shall be afforded the protection of full Bill of Rights contained in the United States Constitution, except that the Tribe shall not be required to provide legal counsel for indigent persons.

I. APPLICABLE LAWS

1. This Agreement and all rights and obligation hereunder, including matters of construction, validity and performance, shall be governed first by substantive Tribal Laws and Ordinances where applicable, and where Tribal Law is inapplicable, this Agreement shall be governed secondly by Federal laws to the extent applicable.

SISSETON-WAHPETON OYATE, CHAPTER 59. TRIBAL EMPLOYMENT RIGHTS LAW

The contractor/employer must agree to comply with all rules and regulations as set forth in Chapter 59 of the Tribal Employment Rights Law. This agreement will be affirmed in writing and will be signed and dated by the appropriate company officer.

TERO COMPLIANCE PLAN

The contractor/employer must submit an acceptable written compliance agreement to the TERO Office a minimum of five (5) days prior to commencing any work activities on the reservation. The compliance agreement will contain the name, address and telephone number of the contractor/employer, the name of the project, contract number, dollar amount, starting/completion dates and the name of the funding agency.

APPOINTMENT OF A COMPANY LIASION OFFICER

The contractor/employer must designate a responsible company official to monitor all employment, training and contracting related activities to insure that the company is in compliance

with the TERO law.

INDIAN PREFERENCE IN HIRING

The contractor/employer must give preference to qualified Indian applicants (Indian who can perform the required work), for all new positions, job vacancies and negotiated positions. Order of preference shall be as follows:

A. On all protects or contracts where federal/state dollars are being used, Indians who are residents of the reservation will be given first order of preference. Second order of preference will be given to local Indians and third order of preference will be given to all other Indians. Federal contractors shall not, however, discriminate among Indians on the basis of religion, sex, or tribal affiliation.

PROMOTIONS AND SUMMER YOUTH

The contractor/employee shall provide preferential consideration for all promotional and summer youth opportunities and shall actively encourage Indians to see such opportunities.

LAYOFFS AND TERMINATIONS

No Indian employee, who can perform the work required, and who is in another than core crew position, shall be terminated through a layoff or reduction in force while a non-Indian employee in the same job is still employed.

MINIMUM GOALS AND TIMETABLES

Contractor/Employers shall be required to hire and maintain a minimum of 70% Indian preference employees for each craft or skill. If a sufficient number of qualified Indians is available, the TERO Officer may set the preference requirement for all (100%) positions, less the employer's core crew. Core crew is defined as ..."A member of a contractor's or subcontractor's crew who is a regular, permanent employee and is in a supervisory or other key position such that the employer would face a serious financial loss if that position were filled by a person who had not previously worked for that contractor or subcontractor; provided, that the core crew shall not exceed (30%) of the total number of employees employed by the contractor or subcontractor on the contract work."

TERO HIRING HALL AND RECRUITMENT EFFORTS

The contractor/employer is required to contact the TERO Office for recruiting and placement service. The TERO Office shall be given a minimum of forty-eight (48) hours to furnish a qualified referral. The contractor/employer is required to provide the TERO Office with a written list of his/her projected workforce needs, job classifications, openings, hiring policies, experience and skills needed and screening procedures to be used in the selection process.

PERSONNEL PRACTICE AND JOB QUALIFICATIONS

Contractors/employers are prohibited from using job qualifications, criteria or other personnel requirements which have a discriminatory effect on Indians and act as barriers to employment, unless such criteria or requirements are required by business necessity. The contractor/employer shall have the sole responsibility of showing that such criteria or requirements are required by business necessity.

TRAINING

The contractor/employer may be required to develop on-the-job training "opportunities and/or participate in tribal or local training programs, including upgrading programs, and apprenticeship or other trainee programs relevant to the employer needs.

CONTRACTOR AND SUBCONTRACTOR PREFERENCE

Indian preference in contracting and subcontracting is required on all covered projects. An Indian business, contractor or subcontractor must be certified by the TERO Office as a 51% owned, operated and controlled Indian firm. All employers, including contractors and subcontractors, are required to submit an acceptable Indian preference subcontracting compliance plan to the TERO Office a minimum of five (5) days prior to commencing work activities on the project The contractor/employer must maintain a record of all solicitations of offers for subcontract from Indian firms and/or steps taken to locate an acceptable Indian firm. NOTE: Compliance by subcontractors or suppliers is the ultimate responsibility of the prime contractor or employer.

59-03-07 *Bidding Procedure For Covered Employers*

Covered employers must seek competitive bidding on all contracts, subcontracts, purchase of goods, vendors, services, procurement, or grants in an amount of $1,000.00 or more and provide Indian preference as required by this Ordinance. The covered employer shall publish a request for bids in the Sota Iya Ye Yapi and with the TERO Office. However, a certified covered employer is not required to place an advertisement in the Sota Iya Ye Yapi if the certified covered employer employs 10 or fewer employees and instead contacts the TERO office for a list of potential contractors and/or subcontractors.

UNION COMPLIANCE

All employers, contractors, or subcontractors who have a collective bargaining agreement with any union must file a written agreement stating that the union will comply with the provisions, rules, regulations and order of the TERO law. Failure by an employer to file a union compliance agreement with the TERO Office will constitute non-compliance.

OBLIGATIONS OF COVERED EMPLOYER

REPORTS: The contractor/employer shall submit the following reports to the TERO Office on a weekly or monthly basis:

A. New Hires

B. Wage, Certified Payroll and Hour Reports

C. Promotions

D. Terminations/Layoffs & Disciplinary Action Taken

E. Any other information specified by the Director and reasonably necessary in monitoring the specific project.

ON-SITE INSPECTIONS

The TERO Director of his/her designee shall have the right to make on-site inspections and conduct compliance investigations at all sites where employment is taking place under the provisions of this compliance agreement. Except in unusual circumstances, inspections will take place during regular working hours.

EMPLOYMENT RIGHTS FEE

Pursuant to Title 7 of the TERO Law, the prime contractor shall pay a fee of three percent (3%) of the total amount of the contract. The fee shall also apply to increases in the contract due to change orders. Fees are payable at the time the compliance plan is negotiated and before work commences on the project Fees for any change orders are due and shall be paid on the date the contractor is notified of the allowance of such increase. In contracts where the TERO fee exceeds ten thousand dollars ($10,000.), the contractor may be allowed to pay the fee in installments payable over the life of the contract Please note that any fee that is paid in installments shall be subject to interest charges at the prime interest rate as provided in the TERO law. Any contractor

who fails to pay the fee imposed shall be subject to the remedial actions provided for in the TERO law.

WORK ENVIRONMENT AND NON-SEGREGATED FACILITIES

The contractor/employer must ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites and in all facilities at which the employees are assigned to work. In construction, the contractor, where possible, will assign two or more females to construction projects. The contractor shall specifically ensure that all superintendents, foremen, and other on-site supervisory personnel are aware of and carry out the contractor's obligations under the TERO law. The contractor/employer must publicize and disseminate their Indian preference policy by providing notice of the policy to their employees, referral sources, subcontractors, suppliers, unions and training programs. Methods for dissemination should include: advertising in the news media, poster (placed at project sites), notices on company bulletin boards, newsletters, and notices on employment applications.

COMPLIANCE WITH ALL OTHER LAWS

The contractor/employer acknowledges that he/she is aware of other Tribal regulations that may affect this contract, including, but not limited to, Tribal Use Tax and Business License requirements.

Contact Information

TERO office, DelRay D. German, Director (605)698-8263 Email DelRayG@swo-nsn.gov
TERO Compliance Officer II, Dustin Kirk (605)698-8267 TERO.Compliance2@swo-nsn.gov

Tax & Business License office, Brenda Bellonger, Director (605)698-8415
BrendaB@swo-nsn.gov
Tax Compliance Officer, Mark Keoke (605)698-8417 CompOfficer@swo-nsn.gov

"General Decision Number: SD20240021 11/22/2024

Superseded General Decision Number: SD20230021

State: South Dakota

Construction Type: Building

Counties: Beadle, Clark, Day, Deuel, Edmunds, Faulk, Grant, Hamlin, Hand, Hyde, Jerauld, Kingsbury, Marshall, McPherson, Roberts and Spink Counties in South Dakota.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

|_____|_____|

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/05/2024
1	07/12/2024
2	07/19/2024
3	07/26/2024
4	11/15/2024
5	11/22/2024

ASBE0057-001 07/01/2021

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Duct, Pipe & Mechanical System Insulation)	$ 31.00	15.00

CARP0587-001 05/01/2024

	Rates	Fringes
CARPENTER (Drywall Hanging and Metal Stud Installation Only)	$ 35.34	16.20

ELEC0426-002 06/01/2024

	Rates	Fringes
ELECTRICIAN	$ 34.02	1.5%+15.58

ELEV0033-004 01/01/2023

	Rates	Fringes
ELEVATOR MECHANIC	$ 51.68	37.335+a+b

FOOTNOTES:

A. Employer contributes 8% of regular basic hourly rate as vacation pay credit for employees with more than 5 years of service, and 6% for employees with less than 5 years of service.

B. PAID HOLIDAYS: New Year's Day; Memorial Day; Independence Day; Labor Day; Veteran's Day; Thanksgiving Day; Day after Thanksgiving; & Christmas Day.

ENGI0049-009 09/01/2024

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
(1) Tower Crane	$ 34.38	18.71
(3) Hydro Crane; Crane (All Other Types)	$ 34.08	18.71

Long Boom Pay: 151' to 200' - $0.50 per hour additional; 201' and over - $0.60 per hour. Measurement shall be from butt pins of the boom to the top of the sheave or jib sheave. Tower Crane Premium: From the top of the tower crane foundation to the top of the tower crane apex. In the case of luffing cranes, to the top of Gantry, plus boom length per classification:

250' to 299' - $1.00
300' to 349 - $1.50
350' to 399' - $2.00
400' to 449' - $2.50
450' and over - $3.00

IRON0021-018 05/01/2024

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 30.80	15.48

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* PLAS0538-001 10/01/2024

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 33.01	15.08

SHEE0010-022 06/01/2022

	Rates	Fringes
SHEET METAL WORKER (HVAC Duct Installation Only)	$ 30.93	17.22

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* SUSD2012-018 08/21/2014

	Rates	Fringes
BRICKLAYER	$ 31.88	1.83
CARPENTER, Excludes Drywall Hanging, and Metal Stud Installation	$ 17.28	3.37
LABORER: Common or General	$ 11.45 **	2.28
LABORER: Mason Tender - Brick	$ 14.19 **	0.00
OPERATOR: Backhoe/Excavator/Trackhoe	$ 19.34	0.00
OPERATOR: Bobcat/Skid Steer/Skid Loader	$ 16.14 **	0.00
PAINTER (Brush, Roller, and Spray)	$ 19.22	0.00
PLUMBER	$ 19.02	5.20
ROOFER	$ 14.52 **	2.09

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($17.20) or 13658 ($12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any

solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

State Adopted Rate Identifiers

Classifications listed under the ""SA"" identifier indicate that the prevailing wage rate set by a state (or local) government was adopted under 29 C.F.R   1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an

internal number used in producing the wage determination. 01/03/2024 reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

TRIBAL PREVAILING WAGE SCALE – Commercial & Building Construction

Effective: January 2024, on all projects that occur within or near the Exterior Boundaries of the Lake Traverse Reservation

(This scale may change without notice due to geographical market trends and/or cost of living allowance)

Commercial & Building Construction – (other than Residential)

Classification	Minimum wage	Final
Boilermaker	*18.50*	25.97
Bricklayer	20.39	32.00
Carpenter	20.50	31.00
Cement Mason/finisher	20.39	26.45
Drywall taper/finisher	16.50	25.00
Electrician	18.60	29.78
Ironworker	22.92	28.92
Laborer-Concrete rebar	13.50	15.50
Laborer-General	13.50	15.50
Roofer	15.31	19.00
Painter	17.39	28.00
Pipefitter	15.31	22.20
Plumber	18.60	32.20
Welder	15.31	32.00
Insulation Installer/Appl.	13.50	15.50
Sheet metal	18.50	26.45
HEO-Backhoe/Excavator	26.07	32.02
HEO-Blade /Grader	26.07	32.02
HEO-Bulldozer/Loader	26.07	32.02
HEO-Roller	24.68	26.02
Driver-Semi-Tractor	25.88	32.00
Driver-Tandem w/pup	25.88	32.00

ACORD CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YY)

PRODUCER

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

INSURERS AFFORDING COVERAGE

INSURED

INSURER A:
INSURER B,
INSURER C,
INSURER D,
INSURER E,

COVERAGES

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AG6REGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DDIYY)	POLICY EXPIRATION DATE (MM/DDIYY)	LIMITS	
	GENERAL LIABILITY				EACH OCCURRENCE	$ 1,000,000.00
	X COMMERCIAL GENERAL LIABILITY				FIRE DAMAGE (Any one fire)	$ 50,000.00
	CLAIMS MADE X OCCUR				MED EXP (Any one person)	$ 5,000.00
					PERSONAL & ADV INJURY	$ 1,000,000.00
					GENERAL AGGREGATE	$ 1,000,000.00
	GEN'L AGGREGATE LIMIT APPLIES PER:				PRODUCTS - COMP/OP AGG	$ 1,000,000.00
	policy project loc					
	AUTOMOBILE LIABILITY				COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000.00
	X ANY AUTO				BODILY INJURY (Per person)	$
	ALL OWNED AUTOS				BODILY INJURY (Per accident)	$
	SCHEDULED AUTOS				PROPERTY DAMAGE (Per accident)	$
	HIRED AUTOS					
	NON-OWNED AUTOS					
	GARAGE LIABILITY				AUTO ONLY - EA ACCIDENT	$
	ANY AUTO				OTHER THAN AUTO ONLY: EA ACC	$
					AGG	$
	EXCESS LIABILITY				EACH OCCURRENCE	$ 1,000,000.00
	X OCCUR CLAIMS MADE				AGGREGATE	$ 1,000,000.00
	DEDUCTIBLE					$
	RETENTION $					$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY				WC STATU-TORY LIMITS OTH-ER	
					E.L. EACH ACCIDENT	$ 500,000.00
					E.L. DISEASE - EA EMPLOYEE	$ 500,000.00
					E.L. DISEASE - POLICY LIMIT	$ 500,000.00
	OTHER					

DESCRIPTION OF OPERATIONS/LOCATIONSIVEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

For all work done during policy period.
Instructional Building
Agency Village, South Dakota

CERTIFICATE HOLDER

ADDITIONAL INSURED; INSURER LETTER:

Sisseton Wahpeton College
BIA Road 700
Agency Village South Dakota

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT.

AUTHORIZED REPRESENTATIVE

(DACORD CORPORATION 1988

INSTRUCTION SHEET

FOR ACORD CERTIFICATE OF INSURANCE 25-S (7/90). THIS INSTRUCTION SHEET WITH SUPPLEMENTAL ATTACHMENT REPLACES AIA DOCUMENT G705

A. Purpose

The Acord form certificate is widely used to certify the coverage required of contractors under the terms of AIA Document A201, General Conditions of the Contract for Construction. Since the Acord certificate does not have space to show all the coverages required in AIA Document A201, the Supplemental Attachment form on the reverse side of this document should be completed, signed by the Contractor's insurance representative and attached to the Acord certificate.

B. Completing the Forms

The Insured's General Liability, Automobile Liability, Excess Liability, and Worker's Compensation and Employers Liability can be shown on the Acord certificate in the proper boxes. Additional information about the General Liability and Voluntary Compensation should be shown on the Supplemental Attachment.

The Acord certificate uses the word "endeavor" in the notice provisions. AIA Document A201 requires absolute notice to the holder 30 days prior to cancellation or expiration of the required coverages. The Supplemental Attachment reflects this obligation.

C. Additional Obligations

Subparagraph 9.10.2 of AIA Document A201 contains a requirement that the Products and Completed Operations insurance be carried for a specified period of time after final payment has been received for the Project for which the certificate and Supplemental Attachment have been issued. The insurance representative should note this requirement when reviewing the Insured's insurance program. The insurance representative should obtain and review a copy of the Contract to be sure all insurable obligations are noted.

If additional language from AIA Document A511 has been incorporated into the Contract for Construction, other insurance obligations may be required of the Contractor and should be shown on the Acord certificate or the Supplemental Attachment.

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SUPPLEMENTAL ATTACHMENT FOR ACORD CERTIFICATE OF INSURANCE 25-S (7/90).

AIA DOCUMENT G715

(This document replaces AIA Document G705, Certificate of Insurance.)

PROJECT SWC Instructional Building, BIA Road 700, Agency Village, South Dakota

INSURED _____

		Yes	No	N/A
A. General Liability				
1.	Does the General Aggregate apply to this Project only?	☐	☐	☒
2.	Does this policy include coverage for:			
a.	Premises—Operations?	☒	☐	☐
b.	Explosion, Collapse and Underground Hazards?	☒	☐	☐
c.	Personal Injury Coverage?	☒	☐	☐
d.	Products Coverage?	☒	☐	☐
e.	Completed Operations?	☒	☐	☐
f.	Contractual Coverage for the Insured's obligations in A201?	☒	☐	☐
3.	If coverage is written on a claims-made basis, what is the:			
a.	Retroactive Date?	_____		
b.	Extended Reporting Date?	_____		
B. Worker's Compensation				
1.	If the Insured is exempt from Worker's Compensation statutes, does the Insured carry the equivalent Voluntary Compensation coverage?	☐	☐	☒
C. Final Payment Information				
1.	Is this certificate being furnished in connection with the Contractor's request for final payment in accordance with the requirements of Subparagraphs 9.10.2 and 11.1.3 of AIA Document A201, General Conditions of the Contract for Construction?	☐	☐	☒
2.	If so, and if the policy period extends beyond termination of the Contract for Construction, is Completed Operations coverage for this Project continued for the balance of the policy period?	☐	☐	☒
D. Termination Provisions				
1.	Has each policy shown on the certificate and this Supplement been endorsed to provide the holder with 30 days notice of cancellation and/or expiration? List below any policies which do not contain this notice.	☒	☐	☐

E. Other Provisions

_____

Authorized Representative

_____

Date of Issue

CAUTION: You should sign an original AIA document which has this caution printed in red. An original assures that changes will not be obscured as may occur when documents are reproduced.

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CIVIL SITE WORK & UTILITIES
TECHNICAL SPECIFICATIONS
FOR THE
SISSETON WHAPETON COLLEGE
INSTRUCTIONAL BUILDING

AGENCY VILLAGE, SOUTH DAKOTA
MARCH 2025
HELMS # A-9968

DIVISION 01 – GENERAL REQUIRMENTS
DIVISION 02 – EXISTING CONDITIONS
DIVISION 03 - CONCRETE
DIVISION 31 – EARTHWORK
DIVISION 32 – EXTERIOR IMPROVEMENTS
DIVISION 33 – UTILITIES

DIVISION 01 - GENERAL REQUIREMENTS

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SECTION 01 73 29 - CUTTING AND PATCHING 21
SECTION 01 77 00 - CLOSEOUT PROCEDURES 23

SECTION 01 25 00 - SUBSTITUTIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.

1.02 SCOPE

A. This section provides a description of the general requirements for the submission, review, and acceptance of substitute items of material and equipment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. The procedures for requesting and reviewing substitute items of material and equipment shall be as required by the Instructions to Bidders, General Conditions and as supplemented herein.

B. The Contractor shall be responsible for all costs that will result directly and indirectly from the acceptance of the substitute.

* * * END OF SECTION * * *

SECTION 01 31 13 - COORDINATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The General Provisions of the contract, including General and Supplementary Conditions shall apply to the work covered in this Section.

B. Related requirements specified elsewhere.

1. Project Meetings and Job Site Administration - Section 01 31 19.
2. Progress Schedules and Reports - Section 01 32 16.
3. Cutting and Patching - Section 01 73 29

1.02 SCOPE AND DESCRIPTION

A. This section describes the general coordination required between each of the Contractors and the Owner. This section is not intended to cover every item or aspect of the necessary coordination.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. All Contractors or subcontractors working on specific portions of the project shall schedule and conduct their Work as not to impede unnecessarily any Work being done by others on or adjacent to his Work.

B. Each Contractor and Subcontractor shall be responsible for coordinating his Work with the appropriate representative of the Owner to avoid or minimize any interruption of the functions and facilities of said agency.

3.02 SITE WORK COORDINATION

A. The location of all facilities, structures, piping and related appurtenances, both temporary and final shall be coordinated among Contractors, the Owner, and the Engineer.

B. It shall be the responsibility of each Contractor to initiate the procedures necessary to coordinate his work with that of other Contractors and the Owner.

C. Contractors completing initial Work shall temporarily cap piping and mark the location of all buried piping to facilitate completion of final Work.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. Coordination is considered incidental Work with no separate measurement to be made.

4.02 BASIS OF PAYMENT

A. Coordination is considered incidental Work with no separate payment to be made.

* * * END OF SECTION * * *

SECTION 01 32 16 - PROGRESS SCHEDULES AND REPORTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions as supplemented herein, shall apply to the Work covered in this Section.

B. Related documents specified elsewhere:

1. Coordination: Section 01 31 13
2. Progress Meetings and Job Site Administration: Section 01 31 19
3. Cutting and Patching: Section 01 73 29

1.02 DESCRIPTION OF WORK

A. This section is intended to provide a description of the general requirements for the preparation and submittal of:

1. A list of proposed subcontractors and suppliers
2. A proposed construction schedule
3. Monthly progress reports

PART 2 PRODUCTS – None

PART 3 EXECUTION

3.01 LIST OF SUBCONTRACTORS AND SUPPLIERS

A. Prior to the execution and delivery of the Agreement, the successful bidder, if requested, shall submit a complete list of all subcontractors and suppliers with whom he proposes to contract; otherwise, the list shall be submitted prior to moving on the site. The list shall be in addition to the list submitted as part of the proposal and shall be divided into sections corresponding to the specification divisions and shall state name, address, and telephone numbers together with work or items to be furnished.

B. This list is subject to approval of the Engineer and Owner. After approval is given, the list cannot be revised without written approval. This approval does not relieve the Contractor of responsibility for compliance with specified requirements.

3.02 SCHEDULE OF OPERATIONS

A. Refer to the requirements of the General Conditions.

B. If conditions beyond the control of the Contractor justify and an extension of time is

approved, the Contractor shall revise the construction schedule in accordance with the approved extensions.

3.03 MONTHLY PROGRESS REPORTS

A. The Contractor shall submit five (5) copies of a written monthly progress report for review by the Owner and Engineer.

B. The written report shall be in a format provided or approved by the Owner.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. Progress schedules and reports are considered incidental Work with no separate measurement to be made.

4.02 BASIS OF PAYMENT

A. Progress schedules and reports are considered incidental Work with no separate payment to be made.

* * * END OF SECTION * * *

SECTION 01 32 23 - SURVEY AND LAYOUT DATA

PART 1 GENERAL

1.01 GENERAL

A. The requirements and provisions for engineering and layout of survey and layout data are as specified in the General Conditions and as supplemented herein.

B. Topography and profiles showing existing ground elevations and culture were obtained by topographic survey.

C. Helms and Associates will furnish construction staking to prosecute the Work as described below. The Contractor shall make timely demands of the Engineer/Surveyor for such staking. The Contractor shall provide advance written notice of not less than five working days for setting stakes.

1. Stakes showing sewer and grade lines will be provided, at an offset as agreed to by the Contractor, at intervals of not less than 50 feet. Benchmarks for elevation will be provided in close proximity to site.
2. Concrete curb and gutter shall be staked at 25 foot intervals and at all changes in grade or line and will include radius stakes.
3. The subgrade, subbase and base course shall be blue topped at an interval deemed appropriate by the Engineer and agreed with by the Contractor.
4. Building corners at a pre-determined offsets.
5. The contractor shall be responsible for transferring from benchmarks, grade and line stakes all distances and elevations necessary for the execution of the work.
6. The Contractor may request additional staking at the Pre-Construction Conference. Should the Contractor request the setting of stakes in excess of those described above, after the Pre-Construction Conference, the Contractor shall be responsible for the extra cost, which will be prorated on the basis of the total number of stakes set.
7. **Electronic files can be made available for use with a Contractor's GPS system. Contractor will be responsible for the extra cost which Helms and Associates puts into preparing these files for their use and for any additional control points set by Helms and Associates personnel.**

D. The Contractor shall preserve all construction stakes, reference points, and other survey points. In case of their loss or destruction, the Contractor shall be liable for and charged with the cost of their replacement and of any expense resulting from their loss or disturbance. Such surveys shall constitute instruction from the Engineer, and the Contractor shall not proceed with the Work until construction stakes have been provided.

E. Should the Engineer/Surveyor be required to reset construction stakes, the cost for such resetting will be at the then current per diem rates. The charges for such Work will be deducted from the progress payments for the Contractor for the month in which the surveying Work is done by the Owner and thereon paid to the Owner's representative.

* * * END OF SECTION * * *

SECTION 01 35 13 - SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions apply to the Work specified in this Section.

B. The provisions of the Storm Water Discharge Permit (if required) normally issued by the South Dakota Department of Agriculture and Natural Resources (SD DANR) to NSU under SWD General Permit issued in compliance with the Clean Water Act shall apply to all portions of the work.

C. The provisions of the Temporary Dewatering Permit (if required) normally issued by the SD DANR to the Contractor in compliance with the provisions of the South Dakota Water Pollution Control Act and the administrative rules of the State of South Dakota shall apply to all portions of the work.

1.02 SCOPE

A. This Section identifies the special project conditions and procedures required by the above referenced permits.

B. The Contractor shall be responsible for implementing and conforming to all special project procedures and requirements as identified herein.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 STORM WATER DISCHARGE PERMIT REQUIREMENTS

A. In the event a permit is required, Owner will make the application for a Storm Water Discharge Permit for this project. For information regarding the and requirements of the General Storm Water Discharge Permit, contact the EPA.

B. In the event a Storm Water Discharge Permit is required and issued, the Contractor will be required to complete and submit a copy of the Contractor Certification Form for Coverage Under the SWD General Permit for Construction Activities to the South Dakota Department of Environment and Natural Resources and provide a copy to the Engineer.

3.02 TEMPORARY DEWATERING PERMIT REQUIREMENTS

A. Owner will not make an application for a Temporary Dewatering Permit for this project. In the event a Temporary Dewatering Permit is required, the Contractor shall be responsible for making application for the necessary permit. For information regarding the need for and requirements of a Temporary Dewatering Permit, contact the EPA Region 8.

B. In the event a Temporary Dewatering Permit is required and issued, the Contractor shall provide the Owner and Engineer a copy of the permit as issued by the EPA.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. Permits are considered incidental Work with no separate measurement to be made.

4.02 BASIS OF PAYMENT

A. No additional compensation shall be made for costs of applying for or complying with the provisions of a Temporary Dewatering Permit, if required. All costs associated with the application for and compliance with shall be considered incidental to the project cost.

B. No additional compensation shall be made for complying with the provisions of a Storm Water Discharge Permit, if required. All costs associated with the application for and compliance with shall be considered incidental to the project cost.

* * * END OF SECTION * * *

SECTION 01 45 00 - QUALITY CONTROL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.

B. Specific requirements are also presented in the detailed sections of these specifications.

1.02 SCOPE

A. This Section is intended to describe the Contractor's responsibilities regarding quality control.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 TESTING LABORATORY SERVICES

A. **Unless otherwise specified, the Owner's Engineer will provide all the necessary field testing services for soils, granular materials and non-structural concrete identified in the Civil Sitework and Utilities plans.** Where tests or inspections by an independent testing laboratory are required by these specifications, the Contractor shall employ and arrange for, at his expense, the services of an approved independent testing laboratory, satisfactory to the Owner and Engineer, to perform the tests or inspections utilizing recognized standard procedures and criteria.

B. The Contractor shall submit reports and certificates of all inspections and tests in triplicate to the Engineer. The reports and certificates shall become the property of the Owner.

C. The Contractor shall furnish all sample materials required for these tests and shall deliver same to the testing laboratory or other designated agency when and where directed by them.

D. Any additional tests necessary beyond these required under this specification may be ordered by the Engineer to settle disagreements with the Contractor regarding quality of work done. If the Work is defective, the Contractor shall pay all costs of the extra tests and shall correct the Work. If Work is satisfactory, Owner will pay for extra tests.

3.02 FACTORY TESTS

A. Factory tests of mechanical and electrical equipment relative to performance, capacity, rating, efficiency, function, or special requirements shall be conducted in the factory or shop for each item when this type of test is specified and/or required by the Engineer. These tests shall be performed in accordance with applicable standards and test codes.

B. Factory tests shall be set up and accomplished by the equipment manufacturer who shall provide all shop space, tools, equipment, instruments, personnel, and other facilities required for the satisfactory completion of each test.

C. Factory tests may be witnessed by representatives of the Owner and such witnessing, unless

otherwise specified in the technical specifications, will be paid for by the Owner.

D. Where factory tests are required or specified for process equipment under other headings of this specification, reports of the test results shall be submitted to the Engineer for review prior to shipment of the equipment.

3.03 FIELD TESTS

A. Refer to the General Conditions, Supplementary Conditions, and the Technical Specifications.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. Quality control is considered incidental Work with no separate measurement to be made.

4.02 BASIS OF PAYMENT

A. Quality control is considered incidental Work with no separate payment to be made.

* * * END OF SECTION * * *

SECTION 01 55 26 - TRAFFIC CONTROL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work in this Section.

1.02 SCOPE

A. This Section describes the Contractor's responsibilities for controlling vehicular and pedestrian traffic in and around the construction sites.

PART 2 PRODUCTS – See Standard Plates Attached

PART 3 EXECUTION

3.01 GENERAL

A. Traffic shall be maintained in accordance with the Manual on Uniform Traffic Control Devices (MUTCD).

B. Flagger(s) will be required where work activity and/or equipment encroach into a lane open to traffic.

C. Removing, relocating, covering, salvaging and resetting of permanent traffic control devices, including delineation, shall be the responsibility of the Contractor. The cost of this work shall be incidental to the various contract bid items unless otherwise specified in the plans. Any delineators and signs damaged or lost shall be replaced by the Contractor at no cost to the City or State.

D. Non-applicable traffic control devices shall be removed and stored as near as possible to the right-of-way line.

E. Storage of vehicles and equipment shall be as near the right-of-way as possible. Contractor's employees should mobilize at a location off the right-of-way and arrive at the work sites in a minimum number of vehicles necessary to perform the work. Indiscriminate driving and parking of vehicles within the right-of-way will not be permitted. Any damage to the vegetation, surfacing, embankment, delineators and existing signs resulting from such indiscriminate use shall be repaired and/or restored by the Contractor, at no expense to the City or State, and to the satisfaction of the Engineer.

F. The Contractor shall designate an employee whose responsibility is the maintenance of traffic, 24 hours a day and 7 days a week. The person so designated must have training and experience in the field of construction traffic control and be knowledgeable about the Manual on Uniform Traffic Control Devices (MUTCD). The cost of the traffic control person shall be incidental to the contract lump sum price for Traffic Control Miscellaneous. The employee selected must be approved by the Engineer. The name, phone number, and location of person(s) shall be provided to the BIA and Tribal Police department.

G. Traffic control devices shall meet the crashworthy requirements of the National Cooperative Highway Research Program Report 350 (NCHRP 350) for Category III. Category III traffic control devices include barriers or other fixed or high mass devices, including portable sign trailers.

H. Portable Sign Trailers used after January 1, 2003 must be crash tested and have received an acceptance letter from the Federal Highway Administration (FHWA).

I. It shall be the responsibility of the Contractor to ensure that all devices meet the applicable NCHRP 350 requirements.

J. All traffic control channelizing devices such as barricades, vertical panels, detour (M4-8, M4-9, or M4-10 series) signs, reflectorized drums, cones, and tubular markers shall be sheeted with micro-cube comer prismatic material effective January 1, 2003. Orange colored material shall be fluorescent.

K. Work activities during non-daylight hours are subject to prior approval.

3.02 HAUL ROUTES

A. The use of public roadways by the Contractor, his subcontractors, and his suppliers to transport equipment and other materials to and from the job site shall be in compliance with applicable State and County highway requirements, including seasonal legal load and speed limits.

B. The Contractor shall be responsible for contacting the appropriate officials for definition of seasons, specific limitations, and specific haul routes.

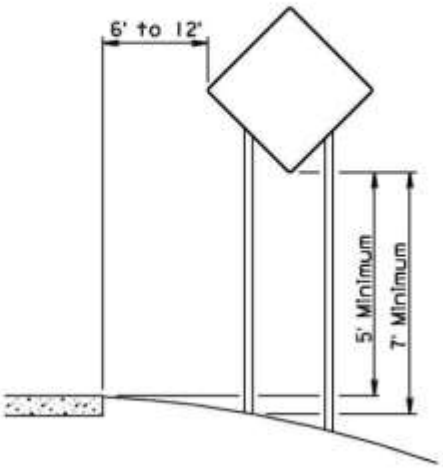
PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

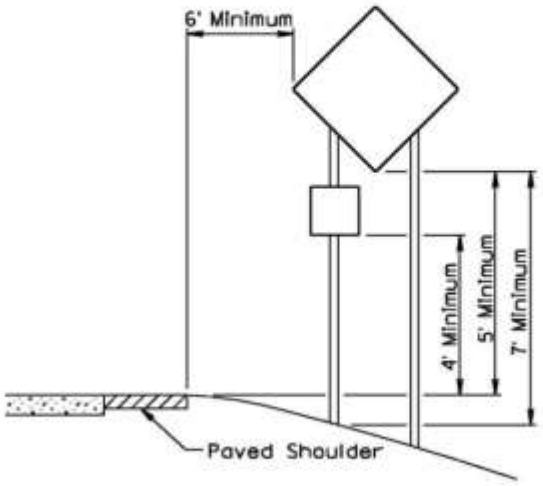
A. Measurement for furnishing, erecting, installing, and maintaining barricades, warning signs or other safety devices or for their subsequent removal, or for flag persons or any other incidentals necessary for the proper direction, safety, and convenience of vehicular and/or pedestrian traffic during construction as this work shall on a lump sum basis.

4.02 BASIS OF PAYMENT

A. Payment for furnishing, erecting, installing, and maintaining barricades, warning signs or other safety devices or for their subsequent removal, or for flag persons or any other incidentals necessary for the proper direction, safety, and convenience of vehicular and/or pedestrian traffic during construction as this work shall be included in the lump sum cost for Traffic Control as provided in the Bid Form.



RURAL DISTRICT



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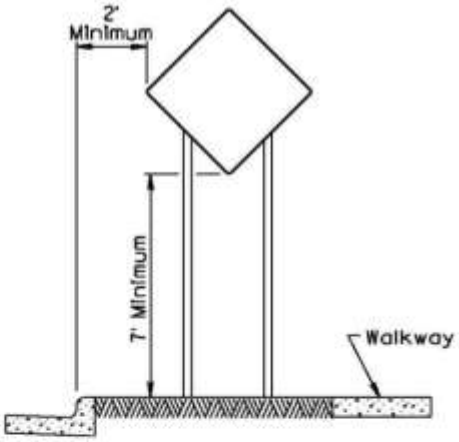

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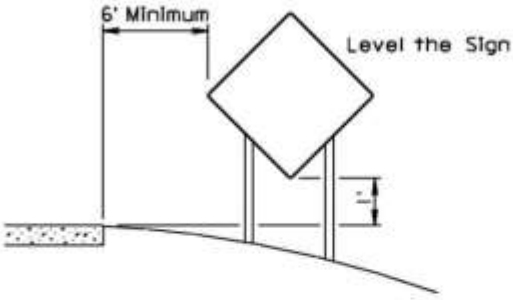

RURAL DISTRICT
3 DAY MAXIMUM

February 14, 2011

Published Date: 1st Qtr. 2012	SDDOT	CRASHWORTHY SIGN SUPPORTS (Typical Construction Signing)	PLATE NUMBER 634.85
			Sheet 1 of 1

* * * END OF SECTION * * *

SECTION 01 57 00 - TEMPORARY CONTROLS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered on this Section.

1.02 SCOPE

A. This section is intended to describe the temporary controls to be provided by the Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall be responsible for maintaining the site and environment at an acceptable standard throughout the duration of the project.

3.02 NOISE CONTROL

A. Each Contractor shall maintain all equipment, particularly the muffling systems on internal combustion engines, so that acceptable noise levels are not exceeded. Each Contractor shall make every effort to locate noise-producing equipment in areas where the sound will be least offensive. Sound barriers are to be provided if needed.

3.03 DUST CONTROL

A. Each Contractor will provide dust control operations at the time, location, and in such manner that will prevent, or at least minimize, the production of dust in a harmful or annoying amount. Water or dust preventative shall be used for dust control as required.

3.04 WATER CONTROL

A. Each Contractor shall make the appropriate provisions for the proper drainage of the site. Standing pools of surface water and excavations shall be drained as soon as practical. Disposal of said water shall be in accordance with all applicable local, state, and federal laws and regulations.

3.05 EROSION AND SEDIMENT CONTROL

A. Each Contractor shall be responsible for taking such measures as may be appropriate for the control of erosion and sediment from the project site. Such measures may include but are not limited to the following temporary and permanent measures:

1. Topsoil should be removed and stockpiled for later use whenever possible before grading begins.
2. The exposure of the soil should be minimized in both terms of area and time.
3. Use temporary vegetation to protect cleared, graded, or disturbed areas that will otherwise be exposed to erosion for prolonged periods before the permanent vegetation and landscaping can be established. Apply needed ground cover on exposed areas within 15 days of exposure except on those sites where construction will begin within 30 days. If construction plans are

suspended, areas should be seeded or mulched without delay. When it is not practical to plant temporary vegetation, spread mulch materials (such as grain straw) on the soil surface to provide desired protection.

4. Natural vegetation should be retained whenever feasible.
5. Appropriate structural or agronomic practices to control runoff and sedimentation should be provided during and after construction.
6. Early completion of stabilized drainage system (temporary and permanent systems) will substantially reduce erosion potential.
7. Roadways and parking lots should be paved or otherwise stabilized as soon as feasible.
8. Clearing and grading should not be started until a firm construction schedule is known and can be effectively coordinated with the grading and clearing activity.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. Temporary controls are considered incidental Work with no separate measurement to be made unless specifically listed in the Bid Form.

4.02 BASIS OF PAYMENT

A. Temporary controls are considered incidental Work with no separate payment to be made unless specifically listed in the Bid Form.

* * * END OF SECTION * * *

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general requirements of the Contract including General and Supplementary Conditions and as supplemented herein shall apply to the Work covered by this Section.

B. Related requirements specified elsewhere:

1. Coordination - Section 01 31 13.

1.02 SCOPE AND DESCRIPTION

A. This section describes the necessary coordination, materials and labor associated with cutting and patching of completed Work or connection of specified Work to existing facilities.

1.03 SUBMITTALS

A. Prior to cutting which may affect the structural integrity of any structure, facility or portion of the project, or Work of another Contractor, or completed Work or existing facilities, the Contractor shall submit written notice to the Engineer requesting consent to proceed with the cutting. The notice shall designate the location, date and time the Work will be exposed for observation, and cutting will be initiated and completed.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials for cutting and patching shall comply with the Specifications for the type of Work to be done.

PART 3 EXECUTION

3.01 GENERAL

A. Cutting (including excavating), fitting or patching of Work shall be executed as required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work
3. Install and properly fit specified Work in existing construction, facilities, or structures.
4. Remove and replace Work not conforming to requirements of Contract-Legal Documents, Specifications, or Drawings.
5. Remove samples of installed Work as specified for testing.

B. The Work of another Contractor, Work already completed, or existing facilities shall not be cut without the consent of the Engineer.

3.02 INSPECTION

A. Representatives of the Contractor, Owner, and Engineer shall, before starting Work on that portion of the project, inspect and record the existing conditions of Work, including elements

subject to movement or damage during:

1. Cutting and patching
2. Excavating and backfilling

B. After uncovering the Work, the Contractor and Engineer shall inspect Work and note all conditions affecting installation of new products.

3.03 PREPARATION

A. The Contractor shall be responsible for providing shoring, backing and support as required to maintain structural integrity of the Work, protect other work, and provide protection from the elements.

3.04 PERFORMANCE

A. The fitting and adjustment of products and material shall be executed to provide a finished installation that will comply with specified tolerances and finishes.

B. All cutting and demolition shall be executed by methods that will prevent damage to other Work, and will provide the proper surfaces to receive installation of repairs and new Work.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. Cutting and patching is considered incidental Work with no separate measurement to be made.

4.02 BASIS OF PAYMENT

A. The cost of cutting and patching to complete Work as specified and shown on the Drawings shall not be measured and paid directly but shall be considered incidental to the project as bid.

* * * END OF SECTION * * *

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.

B. Related requirements specified elsewhere: N/A

1.02 SCOPE

A. This Section is intended to describe the procedures and Contractor's responsibilities for substantial and final completion of the Work and final closeout of the Project.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CLEANUP

A. The requirements shall conform to the General Conditions and as supplemented herein.

B. The Contractor shall leave the site clean and ready for occupancy by the Owner. Early acceptance of process equipment shall not waiver cleanup prior to final acceptance.

C. Flushing water or water pumped from dewatering of various elements of the Work which may be necessary during construction shall be conducted by temporary pipelines or wood or metal flumes away from the work area to natural drainage ways. Flushing or drainage shall not be conducted in such a manner as to cause erosion or flooding of adjacent land not owned or controlled by the Owner, except by special permission in writing by the Owner and affected landowner.

D. The Contractor shall assure that water discharged to any location during construction does not damage the natural environment or wildlife. The Contractor shall be responsible for any environmental damage that results from his activities.

E. Each Contractor shall provide cleaning of all surfaces, systems, and fixtures, including removal of labels, tags, grease, oil, dirt stains, etc., prior to final acceptance of the work.

3.02 PROJECT RECORDS

A. All documents shall be filed in a neat, orderly manner, which allows ready access and inspection.

B. All documents shall be available to Engineer and shall be delivered to him for the Owner upon completion of the project. Quality and completeness of all drawings and records must be such that the Engineer may accurately transfer the information to a complete set of drawings of construction records.

3.03 FINAL INSPECTION

A. After the cleaning up of the work, premises, manholes, and all other areas and structures connected with the performance of the contract, the work as a whole shall be inspected by the Engineer, and any workmanship or materials found not meeting the requirements of the specifications shall be removed by and at the expense of the Contractor and good and

satisfactory workmanship or material substituted therefore. All settlement, defects, or damage upon any part of the work shall be remedied and made good by the Contractor.

B. Refer also to the General Conditions and Supplementary Conditions for the procedures covering requests for final inspection, application for payments, etc.

3.04 GUARANTEE

A. Refer to the Contract Documents, General Conditions, and Supplementary Conditions.

B. Guarantee on equipment placed into operation prior to final acceptance shall start from the date of written acceptance by the Engineer and Owner.

3.05 LIENS

A. Refer to the General Conditions, Supplementary Conditions, and Specific Project Requirements.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. All costs incurred by the contractor for the execution of the Work specified herein are considered incidental Work with no separate measurement made.

4.02 BASIS OF PAYMENT

A. All costs incurred by the contractor for the execution of the Work specified herein are considered incidental Work with no separate payment made.

* * * END OF SECTION * * *

DIVISION 02 – EXISTING CONDITIONS

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SECTION 02 01 00 - MAINTENANCE OF EXISTING CONDITIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.

1.02 SCOPE

A. This Section describes, but is not limited to, the relationship of the Project to existing underground utilities and the Work associated with the location, adjustment, and repair of underground utilities.

B. The information and data relative to existing underground utilities are provided to assist the Contractor with the preparation of his bid. This information should not be used by the Contractor for reference during construction of the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Existing underground utilities, as shown on the drawings, are located in accordance with available data, but locations may vary and cannot be guaranteed. The exact locations shall be determined by each Contractor as the Work proceeds. Excavation work shall be done carefully so as to avoid damaging the existing utilities and Work.

B. Each Contractor shall provide for protection, temporary removal and replacement or relocation of obstructions as required for the performance of this Work required in these contract documents.

C. Other obstructions not shown on the plans and requiring relocation shall be exposed by the Contractor without injury; or if injured, shall be repaired by Contractor at his expense. Removal of such obstruction or its relocation shall be made by the Contractor according to the provisions of the General Conditions.

3.02 UTILITY CONTACT

A. Prior to Work in a specific area affecting underground utilities, the following individuals shall be notified as appropriate:

B. All above utilities, excepting water, may be located utilizing the South Dakota One Call Notification Center:

(Locate Phone Number) 1-800-781-7474

(Admin. Phone Number) 1-800-422-1242

C. The failure of any utility to be present for any reason, at the Pre-Construction Conference, if

held, shall not relieve the Contractor of any responsibility described herein.

3.03 UTILITY REPAIR:

A. When an underground utility is exposed or damaged, the Contractor shall comply with the repair requirements of the affected utility.

B. When an underground utility is exposed, the Contractor shall compact the backfill beneath the exposed utility before completion of the backfill operation.

3.04 SANITARY/STORM SEWER AND WATER MAIN SEPARATION:

A. Horizontal Separation - Sewers shall be laid at least 10 feet (3.0 m) horizontally from any existing or proposed watermain. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot (3.0 m) separation, the Department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a watermain, provided that the watermain is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the watermain is at least 18 inches above the top of the sewer.

B. If it is impossible to obtain proper horizontal separation as described above, both the watermain and sewer shall be constructed of slip-on or mechanical joint pipe complying with public water supply design standards of the Department and be pressure tested in accordance with AWWA standards to assure water tightness before backfilling.

3.05 Vertical Separation

A. Sewers Crossing Under Watermains - The sewer shall be laid to provide a minimum of 18 inches from the top of the sewer to the bottom of the watermain. The crossing shall be arranged so the sewer joints will be equidistant and as far as possible from the watermain.

B. Sewers Crossing Over Watermains - Either the watermain or the sewermain must be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.

C. Special Conditions - When it is impossible to obtain the proper horizontal and vertical separation as stipulated above, one of the following methods shall be specified:

D. Water Pipe - The sewer shall be designed and constructed equal to water pipe and shall be pressure tested in accordance with AWWA standards prior to backfilling to assure water tightness; or;

E. Carrier Pipe - Either the watermain or the sewermain may be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.

3.06 Storm Sewer Requirements:

A. A reinforced concrete pipe (RCP) storm sewer may cross below a watermain with a separation of less than 18 inches or at any height above a watermain provided the joints on the RCP within 10 feet of either side of the watermain are assembled with:

B. Preformed butyl rubber sealant meeting federal specification #SS-S-210Aand AASHTO M 198, and each of these joints are encased with a minimum 2-foot wide by 6-inch thick concrete collar centered over the joint and reinforced with the equivalent steel area as that in the RCP. Encasement of the watermain will not be required when the RCP joints are collared within the 20-foot section.

C. An O-ring that conforms to ASTM C 443 specifications. O-rings are manufactured for concrete pipe with diameters up to 18 inches.

D. A strip of impermeable material held in place with stainless steel bands and tested to 5 psi prior to the storm sewer being put into use.

E. There shall be at least a 10-foot horizontal separation between watermains and sanitary sewer forcemains. There shall be an 18-inch vertical separation at crossings as required in paragraphs B and C.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate measurement made.

4.02 BASIS OF PAYMENT

A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate and payment to be made.

* * * END OF SECTION * * *

SECTION 02 30 00 - SUBSURFACE INVESTIGATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions and the provisions of Division I, General Requirements, apply to the work specified in this section.

1.02 SCOPE AND DESCRIPTION

A. The Contractor shall accept the project site in its present condition. He shall do all clearing, demolition and relocation, excavation, filling, backfilling, and grading necessary for the construction of all structures, piping, embankments, driveways, pond piping, miscellaneous structures, and all required utility construction in accordance with these specifications and in conformity with the dimensions and finished grades as shown on the plans. Excavation shall include removal of rock, dewatering, sheeting, and shoring as necessary to provide space for the required construction procedures.

B. Unless otherwise required, the Contractor shall return all areas disturbed by him to their original grade and seed or sod in accordance with the specifications.

1.03 SOIL INFORMATION

A. **A soils investigation was completed by Soil Technologies, Inc, Mobridge, SD. The report and any test results are available at the office of HKG Architects, Aberdeen, S.D.**

B. The samples tested are not guaranteed to be indicative of any ground except at the particular and exact location of the sample. No claim shall be made or be considered resulting from any deviations from the sample test data. This information is made available to the Contractor for his own use and is in no event considered as a part of the contract.

C. It shall be the Contractor's responsibility to determine to his own satisfaction the location and nature of all surface and sub-surface obstacles and the soils and water conditions which will be encountered during the construction of the treatment facility associated structures and piping.

D. Additional test borings and other exploratory operations as may be desired may be made by the Contractor at no cost to the Owner.

* * * END OF SECTION * * *

DIVISION 03 – CONCRETE

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SECTION 03 11 00 - CONCRETE FORMWORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions, apply to the work specified in this section.

B. Related Work specified elsewhere:

1. Concrete Reinforcement - Section 03 20 00
2. Concrete Joints and Water Stop - Section 03 15 00
3. Cast-in-place Concrete - Section 03 30 00

1.02 DESCRIPTION OF WORK

A. The extent of formwork is indicated by the concrete structures shown on the drawings.

B. The work includes providing of the form work and shoring for cast-in-place concrete, and installation into formwork of items required such as anchor bolts, setting plates, bearing plates, anchorages, inserts, frames, nosings, and other items to be embedded in concrete (but not including reinforcing steel).

1.03 QUALITY ASSURANCE

A. Examine the substrate and the conditions under which concrete formwork is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Codes and Standards: Unless otherwise shown or specified, design, construct, erect, maintain, and remove forms and related structures for cast-in-place concrete work in compliance with the American Concrete Institute standard ACI 34, "Recommended Practice for Concrete Formwork."

C. Allowable Tolerances: Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347, and as follows:

1. Variation from plumb in lines and surfaces of columns, piers, walls, and arises; ¼-inch per 10-foot, but not more than 1-inch total. For exposed corner columns, control joint grooves, and other conspicuous lines, ¼-inch in any bay or 20 feet maximum; ½-inch maximum in 40 feet or more.
2. Variation from level or grade in slab soffits, ceilings, beam soffits, and in arises ¼-inch in 10 feet, 3/8-inch in any bay or 20 feet maximum and ¾-inch in 40 feet or more. For exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, ¼ inch in any bay or 20 feet maximum, and ½-inch in 40 feet or more.
3. Variation from position of the linear building lines and related columns, walls, and partitions, ½-inch in any bay or 20 feet maximum and 1-inch in 40 feet or more.
4. Variation in sizes and locations of sleeves, floor openings, and wall openings, ¼-inch.
5. Variation in cross sectional dimensions of columns and beams and thickness of slabs and walls, minus ¼-inch and plus ½-inch.

6. Variations in footings plan dimensions, minus ½-inch and plus 2-inch misplacement or eccentricity, 2% of the footing width in direction of misplacement but not more than 2-inch thickness reduction, minus 5%.
7. Variation in steps: in a flight of stairs, 1/8-inch for rise and ¼-inch for treads; in consecutive steps, 1/16-inch for rise and 1/8-inch for treads.

D. Before concrete placement, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

E. During concrete placement, check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed, plywood-faced, or other panel type materials acceptable to Engineer to provide continuous, straight, smooth, as-cast surfaces. Furnish in largest practicable sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

B. Form concrete surfaces, which will be unexposed in the finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least two edges and one side for tight fit.

C. Form ties shall be shall be of removable end, permanently embedded body type and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. Unless otherwise shown, cones shall be provided on the outer ends of each tie and the permanently embedded portion shall be at least 1-inch back from the concrete face. Form ties for water bearing walls shall be provided with water seal washers located on the permanently embedded portions of the ties at the approximate center of the wall. Permanently embedded portions of form ties that are not provided with threaded ends shall be constructed so that the removable ends are readily broken off without damage to the concrete. The type of form ties used shall be acceptable to the Engineer. Form ties fabricated on the project site and the wire ties are not acceptable.

D. Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

E. Provide metal inserts for anchorage of materials or equipment to concrete construction not supplied by other trades and as required for the work.

2.02 FORMS FOR PAVEMENT, SIDEWALK, AND CURB & GUTTER

A. Forms shall have a depth not less than the prescribed edge thickness of the pavement. Built up forms with horizontal joints shall not be used.

B. When staked in place, forms shall withstand the pressure of the concrete and the impact and vibration of any equipment they are required to support, without significant springing, settlement, or lateral displacement.

C. Bent, twisted, or broken forms and those with battered top surfaces shall be removed from the work. Repaired forms shall not be used until inspected and approved.

D. The top face of any form shall not vary from a true plane by more than 1/8-inch in 10 feet, nor shall the contact face of a straight form vary from a true plane by more than ¼-inch in 10 feet.

E. Straight forms shall be metal having a thickness of not less than ¼-inch and shall be furnished in sections not less than 10 feet in length. Each section shall have provisions for locking together the ends of abutting sections. Straight forms shall have a base width of at least eight inches with flange braces extending outward on the base at least 2/3 the height of the form.

F. Flexible or curved forms of proper radius shall be used for curves of 100-foot radius or less. Flexible or curved forms shall be of an acceptable design.

2.03 DESIGN OF FORMWORK

A. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position.

B. Design forms and false work to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.

C. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

D. Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances. Provide camber in formwork as required for anticipated deflections due to weight and pressures of fresh concrete and construction loads for long span members without intermediate supports.

E. Provide temporary openings in wall forms, column forms and at other locations necessary to permit inspection and cleanout.

F. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

G. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

H. Side forms of footings may be omitted and concrete placed directly against excavation only when requested by Contractor and accepted by Engineer. When omission of forms is accepted, provide additional concrete required beyond the minimum design profiles and dimensions of the footings as detailed.

PART 3 EXECUTION

3.01 FORM CONSTRUCTION

A. Construct forms complying with ACI 347, to the exact sizes, shapes, lines, and dimensions shown and as required to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.

B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.

C. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible, consistent with project requirements.

D. Form intersecting planes to provide true, clean cut corners, with edge grain of plywood not exposed as form for concrete.

E. Provide openings in forms to accommodate other work, including mechanical and electrical work. Accurately place and securely support items required to be built into the forms.

F. False work:

1. Erect false work and support, brace, and maintain it to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct false work so that adjustments can be made for take-up and settlement.

2. Provide wedges, jacks, or camber strips to facilitate vertical adjustments. Carefully inspect false work and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimensions.

G. Forms for Exposed Concrete:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.

2. Do not use metal cover plates for patching holes or defects in forms.
3. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
4. Use extra studs, walers, and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
5. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
6. Form molding shapes, recesses, and projections with smooth finish materials, and install in forms with sealed joints to prevent displacement.

H. Corner Treatment:

1. Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines, except as otherwise shown.
2. Form chamfers with ¾ inch x ¾ inch strips unless otherwise shown, accurately formed and surface to produce uniformly straight lines and tight edge joints. Extend terminal edges to the required limit and miter chamfer strips at changes in direction.
3. Unexposed corners may be formed either square or chamfered.

I. See Section 03 15 00 for treatment of control and construction joints. Locate as indicated.

J. Provide openings in concrete formwork to accommodate work of other trades, including those under separate prime contracts (if any). Size and location of openings, recesses, and chases are the responsibility of the trade requiring such items. Accurately place and securely support items to be built into forms.

K. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

3.02 FORM COATINGS

A. Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces that will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

B. Coat steel forms with a non-staining, rust preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.03 INSTALLATION OF EMBEDDED ITEMS

A. Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

B. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

3.04 REMOVAL OF FORMS

A. Formwork not supporting concrete, such as sides of beams, walls, columns, and similar parts of the work that may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations and provided that curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements may not be removed in less than 14 days and not until concrete has attained design minimum 28-day compressive strength.

C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.05 RE-USE OF FORMS

A. Cleaned and repaired surfaces of forms may be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT & BASIS OF PAYMENT

A. Concrete formwork will not be measured for direct payment and will be considered subsidiary work pertaining to the contract.

4.02 BASIS OF PAYMENT

A. No direct compensation will be made for this work. Payment will be included in the contract bid prices as shown on the Bid Form.

* * * END OF SECTION * * *

SECTION 03 15 00 - CONCRETE JOINTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions, apply to the work specified in this section.

B. Related Work Described Elsewhere:

1. Concrete Formwork: 03 11 00
2. Concrete Reinforcement: 03 20 00
3. Cast-in-place Concrete: 03 30 00

1.02 DESCRIPTION OF WORK

A. The extent of each type of concrete joint required on foundation walls is shown on the drawings.

1.03 SUBMITTALS

A. Manufacturer's catalog data and installation instructions.

PART 2 PRODUCTS

2.01 PREFORMED EXPANSION JOINT FILLER

A. Preformed, non-extruding-type joint filler constructed of closed cell polyethylene foam of firm texture. Conform to ASTM D1752, Sections 3.1 to 3.4.

2.02 JOINT MATERIAL

A. All joint material in contact with potable water shall meet requirements of the SD Dept of Agricultrual & Natural Resources and be safe for use with a drinking water supply.

B. The backer rod shall be a non-moisture absorbing, resilient material approximately 25 percent larger in diameter than the width of the joint to be sealed. The backer rod shall be compatible with the sealant and no bond or reaction shall occur between the rod and the sealant.

C. Hot Poured Elastic Joint Sealer: The sealant shall conform to the requirements of ASTM D3405. The manufacturer shall furnish a certificate of compliance for the material.

D. Low Modulus Silicone Sealant: Low modulus silicone sealant shall be furnished in a one-part silicone formulation. The sealant must meet the following requirements:

TEST	LIMIT	TEST METHOD
Tack Free Time	20-75 minutes	MIL S 8802
Specific Gravity	1.010-1.515	ASTM D792 (Method A)

TEST	LIMIT	TEST METHOD
Durometer Hardness Type A: [Cured 7 days at 77°F ±3° (25° C ±2°) and 45% to 55% R.H.]	10-25 0°F (-18° C)	ASTM D2240
Tensile Stress: [at 150% elongation, 7 day (Die C) cure at 77° F ±3° (25°C ±2°) and 45-55% R.H.]	45-psi (310 kPa) max.	ASTM D412
Elongation: [7 day cure at 77° F ±3° □ (25° C (Die C) ±2°) & 45-55 R.H.]	1000% min.	ASTM D412
Shelf Life	6 month minimum from date of manufacture	
Ozone & Ultra Violet Resistance	No chalking, cracking or bond loss after 5000 hrs.	
Movement capability and adhesion [7 day cure in air 77° F ±3° (25° C ±2°)]	No adhesive or cohesive failure, * all 3 specimens must exceed 500% extension at 0° F (-18° C)	
Bond to Concrete Mortar Concrete briquettes [air cured 7 days at 77°F ±3° □ (25° C ±2°)]	50 psi (345 kPa) min. 0° F (-18°C)	AASHTO T132**

* Prepare the specimens using 1" x 2" x 3" (25 mm x 50 mm x 75 mm) concrete blocks made in accordance with ASTM D3407. A sawed face shall be used for bond surface. Seal two inches (50 mm) of block leaving ½ inch (13 mm) on each end of specimen unsealed. The depth of sealant shall be 3/8-inch (10 mm) and the width ½-inch (13 mm). Subject the sealant to movement at a rate of two inches (50 mm) per minute until failure.

** Briquettes molded in accordance with AASHTO T132 sawed in half and bonded with approximately 10 mils (0.25 mm) of sealant and tested using clips meeting AASHTO T132. Briquettes shall be dried to constant weight in oven 100□C ±5□. They shall be tested in tension at a loading rate of 0.3 inches (7.6 mm) per minute.

PART 3 EXECUTION

3.01 CONSTRUCTION JOINTS

A. Place construction joints only where shown. In case of a breakdown in concrete placement, form the resulting unscheduled joint in the same orientation as the joints shown on the drawings for similar portions of the structure and include the key and additional reinforcing as may be required for the design function of the structure.

B. After the concrete has hardened on one side of a construction joint and before placing the next concrete pour, remove the surface laitance and clean exposed surface by dry sandblasting. The sand blasted, roughened joint shall leave sound, exposed aggregate with a surface roughness of 0.2-inch ± 0.1-inch. Just prior to placing the new concrete, coat the horizontal construction joint with a 2-inch layer of cement mortar and spread uniformly and work into all irregularities of the surface. Use cement mortar of the same mixture as the structural concrete but with the coarse aggregate omitted. The mortar shall not exceed the water-cement ratio of the concrete to be placed on it and the consistency shall be suitable for placing and working. Wet the vertical surface to be joined at a construction joint and use additional spading and vibrating to prevent voids.

C. Key construction joints unless otherwise shown. Form keyways with beveled strips or boards placed at right angles to the direction of shear. Make keyways at least 1.5 inch in depth over at least 25% of the area of the section. When necessary to make a joint because of a breakdown or emergency, place reinforcing dowels across the joint. Embed dowels 40 bar diameters on each side of the joint. Match reinforcing in size and number.

D. Provide isolation joints in slabs on ground at all points of contact between slabs on ground and vertical surfaces such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

3.02 JOINTS WITH JOINT SEALANT

A. On structures or surfaces, which require joint sealant, do not remove the material for forming the groove in the concrete until the concrete is cured. Upon removing the groove form, sandblast the groove, allow it to dry, then place the primer, backup rod, and sealant into the clean groove in accordance with the manufacturer's recommendations. Prior to sealant application, the manufacturer's representative shall demonstrate joint preparation, priming, and sealant materials for the personnel performing joint work. Groove form material shall be installed prior to concrete placement.

B. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints. Construction joints in water holding structures shall be provided with a half inch beveled notch on the inside surface provided for caulking the joints.

3.03 CONCRETE PAVEMENT JOINTS

A. Immediately after sawing the joints to their final configuration, the resulting slurry shall be completely removed from the joint and the immediate area by flushing with a jet of water and other tools as necessary. Curing membrane damaged or protective cover removed during the sawing operation shall be repaired or replaced by the Contractor as directed by the Engineer at no cost to the Owner.

B. Longitudinal Sawed Joints: Deformed steel tie bars shall be placed perpendicular to the longitudinal joints by approved methods. Tie bars shall not be painted or coated with asphalt or other material, or enclosed in tubes or sleeves. Longitudinal sawed joints shall be cut to the dimensions specified. Suitable guidelines or devices shall be used to assure cutting the joint to a true line. The joint shall be cured a minimum of 24 hours before sawing. The sawed joint will not require reapplication of curing compound. The joint shall be sealed as required in Section 03 15 00.

C. Longitudinal Construction Joints: When adjacent lanes of pavement are constructed separately, a keyway shall be formed along the construction joint. When deformed steel tie bars are required, they may be bent at right angles for the first lane constructed and straightened into final position before the concrete of the adjacent lane is placed. Tie bars shall conform to Section 03 15 00, except that rail steel shall not be used for tie bars that are to be bent and restraightened. The longitudinal construction joint shall be sawed shortly after the end of the curing period and shall be sealed as required in Section 03 15 00.

D. Transverse Contraction Joints: Transverse contraction joints shall be created by sawing. Sawing shall commence when the concrete has hardened sufficiently to permit sawing without raveling. Joints shall be sawed before uncontrolled shrinkage cracking takes place. If necessary, the sawing operations shall be carried on both day and night, regardless of weather conditions. The sawed joint will not require reapplication of curing compound.

E. The sawing of a joint shall be omitted if a crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discontinued when a crack develops ahead of the saw. Any procedure which results in premature and uncontrolled cracking shall be revised immediately by adjusting the sequence of cutting the joints or the time interval involved between the placing of the concrete or removal of curing media and the cutting of joints.

F. Repair or correction of uncontrolled cracks shall be as directed by the Engineer and at the expense of the Contractor.

G. Longitudinal random cracks penetrating the full depth of the pavement shall be grooved and sealed. The top of the crack shall be grooved to a minimum depth of ¾ inch (20 mm) and to a width of not less than 3/8 inch (10 mm) nor more than 5/8 inch (16 mm) by means of a router. The router shall be capable of following the path of the crack and widening the top of the crack to the required dimensions without spalling or damaging the concrete. Loose and fractured concrete shall be removed and the groove shall be thoroughly cleaned and sealed.

H. For PCC Pavement with no load transfer across the contraction joint (dowel bar assemblies are not required), the following shall apply:

   1. When a transverse random crack terminates in or crosses a transverse contraction joint, the uncracked portion of the joint shall be filled with epoxy-resin mortar and the crack shall be routed and sealed in accordance with Section 03 15 00.

   2. Where a transverse random crack parallels the planned contraction joint and is within a distance of five feet (1.5 meters) from the contraction joint in the pavement, the crack shall be routed and sealed in accordance with Section 03 15 00, and the joint shall be filled with epoxy resin mortar.

   3. When a transverse random crack is more than five feet (1.5 meters) from the nearest contraction joint in the pavement, the joint and the crack shall be sealed in accordance with Section 03 15 00. Joints to be filled with epoxy resin mortar shall be thoroughly cleaned.

I. For PCC Pavement with load transfer across the contraction joint (dowel bar assemblies are required), the following shall apply:

1. When a transverse random crack parallels the planned contraction joint and is more than five feet (1.5 meters) from the contraction joint, the crack shall be routed, the backer rod installed, and sealed with silicone according to Section 03 15 00.
2. When a transverse random crack parallels the planned contraction joint and is less than five feet (1.5 meters) from the contraction joint, the pavement shall be sawed full depth, removed, and replaced. Load transfer across the contraction joint shall be re-established.
3. When a transverse random crack intersects or parallels a planned transverse contraction joint and is less than four inches (100 mm) from the planned contraction joint for more than 50 percent of the lane width, the crack shall be routed, the backer rod installed, and sealed with silicone in accordance with Section 03 15 00.
4. When a transverse random crack intersects or parallels a planned transverse contraction joint and is more than four inches (100 mm) from the planned contraction joint for more than 50 percent of the lane width, the pavement shall be sawed full depth, removed, and replaced. Load transfer across the contraction joint shall be re-established.

3.04 SEALING CONCRETE PAVEMENT

A. Joints shall be sealed with hot-poured elastic joint sealer or low modulus silicone sealant as specified. Joints shall be sealed immediately after completion of the curing period, before the pavement is opened to traffic.

B. Joint grooves with spalls greater than ½ inch (13 mm) in depth shall be patched with an approved epoxy mortar. All loose concrete shall be removed from the spalled area and the spalled surface shall be thoroughly cleaned. After cleaning, the spalled surface shall be primed and an epoxy mortar of troweling consistency shall be placed in the spalled area and finished as the original pavement surface. The epoxy binder components shall be proportioned and mixed as recommended by the manufacturer. After the epoxy binder is thoroughly mixed, dry silica sand shall be blended into the mixture to give an epoxy mortar of trowelable consistency.

C. After the epoxy mortar has cured, the forming material shall be carefully removed. The finished joint shall have vertical faces and the joint width shall be maintained. Patching of spalls shall be done only when the temperature of the air and pavement are above 50EF (10EC).

D. Joints to be sealed shall be thoroughly clean and dry. All materials such as old sealant, oil, asphalt, curing compound, paint, rust, and other foreign materials shall be completely removed. Cleaning shall be accomplished by sand blasting and other tools as necessary.

E. Just prior to sealing, each joint shall be blown out using a jet of compressed air, at a working pressure of not less than 90 psi (620 kPa), to remove all traces of dust. Air compressors used for cleaning joints shall be equipped with traps capable of removing all free water and oil from the compressed air.

F. Joint sealer application will not be permitted when the air or pavement temperature near the joint is less than 40EF (5EC) or is 40EF (5EC) and falling.

G. The sealant shall be applied without spilling on the exposed surface. Sealant on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned.

Failure of the joint material in either adhesion or cohesion will be cause for rejection. Repair shall be at the expense of the Contractor.

H. Hot-Poured Elastic Joint Sealer: Hot-poured elastic joint sealer shall be stirred during heating so that localized overheating does not occur. All joints shall be sealed with an approved pressure-sealing device, equipped with a nozzle inserted into the joint, so sealing material will be forced from the bottom of the joint to the top.

I. Silicone Sealant: Silicone sealant shall be applied with a mechanical device equipped with a nozzle or spout shaped to fit into the joint. The joint sealant shall be applied under pressure from the inside of the joint to remove entrapped air and ensure good joint contact.

   1. Backer rod shall be installed to the proper depth to produce the width and depth of sealant specified.

   2. The sealant surface shall be tooled to produce a slightly concave surface ¼-inch (6 mm) below the pavement surface. Tooling shall be accomplished before a skin forms on the sealant surface. The use of soap or oil as a tooling aid will not be permitted.

J. Seasonal Restrictions:

   1. Silicone sealing operations shall be suspended after October 15, unless the Contractor has received written permission from the Engineer to continue sealing. After the October 15 seasonal restriction, only the initial cut shall be performed at all joints. Then the following spring the joints shall be widened, backer rod installed, and sealed with silicone according to Section 03 15 00.

   2. All costs related to the seasonal sealing restrictions including additional labor and materials, equipment, traffic control, mobilization, and incidentals shall be at the expense of the Contractor.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. The joints will not be measured for direct payment and will be considered subsidiary work pertaining to the contract.

4.02 BASIS OF PAYMENT

A. No direct compensation will be made for this work. Payment will be included in the contract bid prices as shown on the Bid Form.

* * * END OF SECTION * * *

SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including general and Supplementary Conditions, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK

A. The extent of concrete reinforcement is shown on the drawings and in schedules.

B. The work includes fabrication and placement of reinforcement for cast-in-place concrete, including bars, welded wire fabric, ties, and supports.

1.03 QUALITY ASSURANCE

A. Examine the substrate and the conditions under which concrete reinforcement is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Codes and Standards: Comply with requirements of the following codes and standards, except as herein modified.

1. American Concrete Institute, ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures."
2. American Concrete Institute, ACI 318, "Building Code Requirements for Reinforced Concrete."
3. American Welding Society, AWS D12.1 "Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction."
4. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

1.04 SUBMITTALS

A. For information only, submit 2 copies of steel producer's mill test certificates identifying chemical and physical analysis of each type of reinforcing steel delivered.

B. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with the ACI 315 "Manual of Standard Practice for Detailing Concrete Structures," show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

1.05 PRODUCT DELIVERY, HANDLING, AND STORAGE

A. Deliver reinforcement to the project site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars shall conform to ASTM A615, Grade 60, except as otherwise indicated.

B. Steel Wire shall be plain wire conforming to ASTM A82.

C. Welded Wire Fabric shall be of the gauge and mesh size as shown conforming to ASTM A185.

D. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place shall be as follows:

1. For bar supports, use CRSI Class C, plastic protected or Class E, stainless steel protected.
2. For slabs on grade, use supports with sand plates or horizontal runners where wetted base materials will not support chair legs.
3. Over waterproof membranes, use precast concrete chairs to prevent penetration of the membrane.

2.02 FABRICATION

A. Shop-fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.

B. Unacceptable Materials shall be defined as reinforcement with any of the following defects and will not be permitted in the work:

1. Bar lengths, depths, and bends exceeding specified tolerances.
2. Bends or kinks not indicated on drawings or on the final shop drawings.
3. Bars with reduced cross section due to excessive rusting or other cause.

PART 3 EXECUTION

3.01 INSTALLATION

A. Unless shown otherwise on drawings, comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.

B. If the cover depth is not specifically indicated on the plan sheets, the reinforcing steel shall be protected by a minimum thickness of concrete as follows:

1. Concrete against ground or exposed to water - 3" cover
2. Concrete exposed to weather - 2" cover
3. Beams and columns - 1 ½ " cover
4. Slabs on grade or exposed to weather - 1" cover

C. Clean reinforcement to remove loose rust and mill scale, earth, ice and other materials, which reduce or destroy bond with concrete.

D. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

E. Unless shown otherwise on drawings, place reinforcement to obtain the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that ends are directed away from exposed concrete surfaces.

F. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with 16-gage wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.

G. Provide sufficient numbers of supports and of strength to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

H. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Comply with requirements of ACI 318 for minimum lap of spliced bars except as shown on drawings.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. Concrete reinforcement will not be measured for direct payment and will be considered subsidiary work pertaining to the contract.

4.02 BASIS OF PAYMENT

A. No direct compensation will be made for this work. Payment will be included in the contract bid prices as shown on the Bid Form.

* * * END OF SECTION * * *

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work of this section.

B. Related Work Specified Elsewhere:

1. Concrete Formwork, Section 03 11 00
2. Concrete Reinforcement, Section 03 20 00

1.02 DESCRIPTION OF WORK

A. The extent of cast-in-place concrete civil work as shown on the civil drawings. All interior concrete or foundation or footings is not subject to these specifications.

B. The work includes providing cast-in-place concrete consisting of Portland cement, fine and coarse aggregate, water and selected admixtures; combined, mixed, transported, placed, finished and cured as herein specified.

1.03 QUALITY CONTROL AND TESTING

A. Prior to any concrete work, the Contractor shall obtain from his concrete supplier a certificate stating the design mix used by the supplier will meet or exceed the requirements of the specifications for Class A concrete as herein specified.

B. The Contractor is responsible for controlling the quality of his product and shall make as many tests as necessary to satisfy himself and the Owner that his product meets or exceeds all specifications contained herein. The Contractor shall employ an independent professional testing laboratory experienced in the testing of concrete materials and mixes to perform material evaluation tests and to test concrete test cylinders. The testing agency shall meet the requirements of ASTM 329. The selection of the testing laboratory shall be subject to the Owner's and Engineer's acceptance. All such tests shall be at the expense of the Contractor.

C. In addition to the Contractor quality control, the Engineer will perform temperature, slump, air, and compressive strength testing for the determination of product acceptance. The Engineer will cast a set of 4 standard 6-inch diameter cylinders for each 10 to 50 cubic yards of concrete placed or portion thereof and care for them as set forth in ASTM C31. These specimens shall be used to determine compressive strength requirements of the product. The results of these tests shall not relieve the Contractor of his responsibility to meet specifications contained herein.

D. The right is reserved by the Owner to order additional checking of concrete strength by use of a Swiss hammer or by boring. Testing of this nature shall be done in the presence of the Engineer at the expense of the Contractor and may be submitted to an independent testing laboratory mutually agreed upon by the Contractor, Engineer, and Owner.

1.04 SUBMITTALS

A. The certificate from the concrete supplier as specified above shall be submitted to the Engineer.

B. The results of all concrete cylinder tests made shall be submitted to the Engineer.

C. Copies of the delivery tickets for each load of concrete delivered to the site shall be furnished to the Engineer at the time of delivery.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Water shall be clean and free of deleterious amounts of oils, acids, alkali, organics, silt, mud, grass, or other foreign material.

B. Portland cement used shall meet the requirements of ASTM C150, Type II, for all usages. Only one brand of cement shall be used throughout the project unless otherwise accepted by the Engineer.

C. Fly ash shall conform to AASHTO M 295 Class F including the optional requirements in the referenced AASHTO specification except as modified by the following:

- Loss on ignition 2.0% Max.
- Moisture content 2.0% Max.
- Available alkalis as Na_2O 1.5% Max. *

  * Available alkalis up to 2.0 percent may be used, provided mortar expansion test results at 14 days is less than or equal to that of the control sample. The expansion test shall be run in accordance with modified ASTM C 441. The control sample shall be made using cement that will be used on the project. The test sample shall be made using cement and fly ash that will be used on the project.

D. Fly ash shall be from approved base loaded electric generating plants using a single coal source. Plants using a limestone injection process for controlling air pollutants are not acceptable. Fly ash from the start up and shut down of the plant shall not be used.

E. Fine aggregate shall be clean, sharp, natural, uncoated sand free from silt, loam, and clay, dune sand, bank run sand and manufactured sand are not acceptable. Fine aggregate shall conform to ASTM C33, fine aggregate sections.

F. Coarse aggregate shall be clean, uncoated crushed stone or gravel conforming to ASTM C33. Clay and shale particles shall not exceed 1%. Maximum size aggregate allowed is 1/5 of narrowest dimensions between forms of the concrete member or 3/4 of minimum clear spacing between reinforcing bars. For cement finish use 1/8 inch minimum and 3/8-inch maximum size aggregate.

G. Aggregates containing soluble salts or other substances such as iron sulphides, pyrite, marcasite, or ochre, which can cause strains on exposed surfaces, will not be allowed.

H. If noted on the plans, fiber mesh reinforcing shall be used with all concrete sidewalk and pavement. The fiber mesh shall be added at the rate of 1 bag per cubic yard or as otherwise recommended by the manufacturer. The fiber shall be added directly to the truck at the time of mixing.

2.02 CONCRETE ADMIXTURES

A. Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed directions. Do not use admixtures, which have not been incorporated and tested in the accepted mixes unless otherwise authorized in writing by the Engineer. All admixtures shall meet standards as specified herein.

B. Air-entraining Admixtures shall conform to ASTM C260 and shall be equal to Grace "Darex AEA," Master Builders "MB-VR"; or Sika Chemicals "AER."

C. Calcium Chloride: Do not use calcium chloride in concrete unless otherwise authorized in writing by the Engineer.

2.03 CONCRETE CLASS

A. Classes of concrete:

CLASS OF CONCRETE	REQ. MIN. STRENGTH @ 28 DAYS (PSI)	MAX. WATER CONTENT GAL./94 LB. BAG
A	4,000	6.0
B	2,500	7.25

1. Class A concrete shall be used for all cast-in-place concrete. Minimum cement content for Class A concrete shall be 564 lbs. It may be used for all concrete requirements.
2. Class B concrete may be used to replace unsuitable materials excavated or as called for on the drawings. Class B concrete shall have a minimum cement content of 470 lbs.

B. Grout and Topping:

1. Plain grout for channel bottoms; tank bottoms where required shall be proportioned as follows:

CONSTITUENT	BY VOLUME
Type II Portland Cement	1 Part
Sand	2 Parts
¼ " Aggregate	1 ½ Parts

2. Non-shrinking grout shall be Embeco, Pour-Rok, or approved equal.

2.04 CONSISTENCY

A. Consistency required for each pour shall be established in advance by the Contractor in cooperation with the Engineer in accordance with ASTM C143 and according to the following slump ranges:

TYPE OF CONSTRUCTION	SLUMP	AIR
Sidewalk	1” - 4 ½”	5% - 7.5%

TYPE OF CONSTRUCTION	SLUMP	AIR
Curb & Gutter	1” - 4 ½”	5% - 7.5%
Pavement (Formed)	1” - 4 ½”	5% - 7.5%
Pavement (Slipformed)	≤ 2”	5% - 7.5%
Miscellaneous	1” - 4 ½”	5% - 7.5%

B. Concrete shall be of consistency as to insure the required workability and result in compacted masses having dense, uniform surfaces. In general, the consistency of concrete mixture shall be such that:

1. The mortar will cling to the coarse aggregate.
2. The aggregates will not segregate in the concrete.
3. The concrete when dropped directly from the discharge chute of the mixer will flatten out at the center of the pile, but the edges of the pile will stand and not flow.
4. The concrete and mortar will show no free water when removed from the mixer.
5. The concrete will slide and not flow into place when transported in metal chutes at an angle of 30 degrees with the horizontal.
6. The surface of the finished concrete will be free from a surface film of "laitance."

C. Any concrete mix failing to meet the above outlined consistency requirements, although meeting the slump requirements, will be considered unsatisfactory; and the mix shall be changed to correct such unsatisfactory conditions.

2.05 PROPORTIONING OF MATERIALS

A. The proper proportioning of aggregates and cement will be determined by the Contractor and the professional testing laboratory. The proportioning of aggregates will be the most suitable combination of aggregates, which will give the necessary workability and desired consistency when mixed with water and cement as specified.

B. The ratio of cement to dry, fine aggregate shall be that necessary to provide the maximum density of the mixture when used with the minimum amount of water required to produce the specified slump in the resulting concrete. This determination of the proper ratio shall be made by a testing laboratory at the expense of the Contractor, using representative samples of the aggregates, which will be used. Laboratory recommendations shall be submitted to the Engineer.

C. The batch proportions used shall be such that full bags of cement are used in each batch.

D. Fly ash may be substituted for cement in concrete. The addition or deletion of fly ash from the mix will be at no cost to the Owner. If fly ash is used, the minimum amount of cement to be replaced is 15 percent and the maximum amount is 20 percent by weight.

2.06 EXPANSION JOINT MATERIAL

A. Expansion joint material shall be pre-molded, non-extruding asphalt impregnated joint filler conforming to ASTM D1751 unless shown otherwise on the plans. Joint material shall be full depth of slab or joint and unless otherwise indicated ½-inch thick.

2.07 FIBER REINFORCEMENT

A. Synthetic Fiber Reinforcement.

1. Material: 100 percent virgin homopolymer polypropylene multifilament fibers, containing no reprocessed olefin materials.
2. Conformance: ASTM C 1116, Type III.
3. Fire Classifications:
   a. UL Report File No. R8534-11.
   b. Southwest Certification Services (SWCS), Omega Point Laboratories No. 8662-1.
4. Fiber Length: Single-cut lengths.
5. Alkali Resistance: Alkali proof.
6. Absorption: Nil.
7. Specific Gravity: 0.91.
8. Melt Point: 324 degrees F (162 degrees C).

PART 3 EXECUTION

3.01 STORAGE OF MATERIALS

A. Cement shall be stored in well ventilated, weatherproof buildings, which will protect the cement from dampness. The floor supporting the cement shall clear the ground a sufficient distance to prevent the absorption of moisture by the cement. The Engineer may permit small quantities of cement to be stored in the open for short periods of time (maximum of 48 hours) if a raised storage platform and adequate waterproof covering are provided. Lumpy or partially set cement shall not be used, and such cement shall be removed from the premises.

B. The handling and storage of concrete aggregate shall be such as to prevent the admixture of foreign materials. If the aggregates are stored on the ground, sites for stockpiles shall be grubbed, cleared of all weeds and grass and leveled off. The bottom layer of aggregate shall not be disturbed or used without cleaning. Unless otherwise authorized by the Engineer, all fine aggregate shall be stockpiled at least 24 hours to reduce the free moisture content.

3.02 MIXING CONDITIONS

A. The concrete shall be mixed in quantities required for immediate use, and any concrete, which is not in place within 30 minutes after being discharged from the mixer, shall not be used. Retempering of concrete will not be permitted.

B. Where work has been started and changes in weather conditions require protective measures to be used, the Contractor shall furnish adequate shelter to protect the concrete against damage from rainfall or damage due to freezing temperatures. In case it is necessary to continue mixing operations during rainfall, the Contractor shall provide protective coverings

for the material stockpiles as well as for the concrete being placed. The covering for aggregate stockpiles will be required only to the extent as may be necessary to control the moisture conditions in the aggregates so that adequate control of the consistency of the concrete mix may be maintained.

C. No concrete shall be mixed without the approval of the Engineer when the air temperature is at or below 40° F (taken in the shade away from artificial heat) and falling. If authorized by the Engineer, concrete may be mixed when the air temperature is at 35° F and rising. When permission is given for mixing when the temperature is below 40° F, the following requirements shall govern:

1. Water used for mixing shall be heated either by steam or by dry heat to a temperature of at least 70° F but not over l50° F.
2. Aggregates shall be heated either by steam or by dry heat to a temperature of at least 70° F but not over 150° F.
3. The heating apparatus shall be such as to heat the mass of aggregates uniformly and preclude the occurrence of hot spots, which will burn the material. Temperature of mixed concrete shall be not less than 60° F at the time of placing in forms. After the concrete has been placed, the Contractor shall provide sufficient protection such as cover, canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than 50° F until at least 60% of the designed strength has been attained.
4. The use of an accelerating agent in lieu of proper cold weather protection will not be authorized. In hot weather suitable precautions shall be taken to avoid drying of the concrete prior to finishing operations. Use of windbreaks, sunshades, fog sprays, or other devices shall be provided.
5. Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperatures shall be less than 90° F.

3.03 CONCRETE PLACEMENT

A. Before placing concrete, the Contractor shall see that bottoms of excavations are undisturbed earth, properly leveled off and tamped free of foreign materials. Forms shall be oiled or wetted prior to placing concrete. Water shall be removed from the excavation before any concrete is deposited.

B. The concrete shall be placed in the structure immediately after mixing. Concrete shall be placed in continuous horizontal layers approximately 12-inch in thickness. Not more than l hour shall elapse between the placing of successive layers of concrete in any portion of the structure included in a monolithic placement. Special care must be used to thoroughly surround all reinforcement with concrete and to leave no air space or other void in this work. All concrete shall be well vibrated into all areas of forms.

C. No concrete shall be used after its initial set has taken place, and no retempered concrete will be allowed under any circumstances or conditions.

D. Concrete handling from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit shall be completed as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.

E. Mechanical equipment for conveying concrete shall be provided to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice, and other deleterious materials.

3.04 CONSTRUCTION JOINTS

A. Construction joints shall be made at the locations indicated on the plans or at such other locations as designated by the Engineer. In no case shall vertical joints be made in walls at or near corners. Proper bonding shall be obtained in accordance with the above specifications and the CRSI.

B. Keys shall be provided in all joints where required to provide for either shear or water tightness. The width of the keys shall be approximately ½ the thickness of the section at that point, and they shall be ½ as deep as they are wide unless otherwise specified.

C. All concrete shall be deposited in forms at such rate that the forms will be filled at any point with a vertical rise of concrete surface of not less than 2 feet per hour. Where necessary, the forms shall be bulk headed off and construction joint made to provide a form, which will be filled at the above specified rate. The location of these construction joints shall be approved by the Engineer.

D. If any concrete is allowed to stand at any elevation below the finished grade or top surface for more than 2 hours without fresh concrete being applied thereon, the top surface shall be considered a construction joint and shall be constructed in accordance with these specifications and provided with keys and water sealing strips.

E. Where practicable, vertical construction joints shall make a slight angle with the vertical, not to exceed ½-inch per foot, in such manner that the freshly deposited concrete will overhang the hardened concrete, allowing the new concrete to settle upon the old during the process of hardening.

3.05 PROTECTING AND CURING

A. All concrete, regardless of temperature, weather, or season, shall be protected from premature drying. Surface cracking shall be a cause for rejection, removal, and replacement. Any concrete poured during freezing or hot weather conditions shall be protected. No salts or other non-freezing materials shall be used. All fresh concrete shall be protected from open rain. All concrete shall be kept damp for at least 6 days after pouring. Membrane curing may be used. Membrane curing compound if used shall be a resin base type approved by the Engineer. Curing will not be required longer than 72 hours if high early strength concrete is used.

3.06 FINISH OF FORMED SURFACES

A. Rough Form Finish:

1. Provide as-cast rough form finish to formed concrete surfaces that are to be concealed in the finish work or by other construction unless otherwise indicated.
2. Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used with tie holes and defective areas repaired and patched and all fins and other projections exceed ¼-inch in height rubbed down or chipped off.

B. Smooth Form Finish:

1. Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view or that are to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete such as waterproofing, damp-proofing, painting or other similar system.
2. Produced smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrical with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off, smooth, and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces unless otherwise shown.

3.07 MONOLITHIC SLAB FINISHES

A. Float Finish:

1. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified.
2. After placing concrete slabs do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float or both. Consolidate the surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding ¼-inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than 2 different angles. Cut down high spots and fill all low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth granular texture.

B. Trowel Finish:

1. Apply trowel finish to monolithic slab surfaces that are to be exposed to view unless otherwise shown and slab surfaces that are to be covered with epoxy terrazzo, resilient flooring, paint, or other thin-film finish coating system.
2. After floating, begin the first trowel finish operation using a power-driven trowel if desired.
3. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with a 10-foot straightedge. Grind smooth surface defects, which would telegraph through applied floor covering system.

C. Non-slip Broom Finish:

1. Apply non-slip broom finish to exterior and interior concrete platforms and bridges, steps, walks and ramps and elsewhere as shown on the drawings or in schedules.
2. Immediately after trowel finishing slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Coordinate the required final finish with the Engineer before application.

D. Exposed Aggregate Finish:

1. The Contractor shall construct an exposed aggregate sample thirty-six (36) inches long by thirty-six (36) inches wide, and receive the Owner's approval, prior to any work involving this type of surfacing.
2. Following the Owner's acceptance of the exposed aggregate sample, and immediately after removal of form work, wash concrete surfaces with water and scrub with stiff bristle brush exposing aggregate to match accepted sample panel.
3. When desired finish is achieved, wash and rinse exposed aggregate surfaces with cleaning agent.

E. Carpet Drag Finish:

1. Before the concrete has attained its initial set, the surface shall be given a final finish with a carpet drag drawn over the surface in a longitudinal direction. The drag shall be mounted on a bridge and shall be sized so that a strip of the carpet at approximately two feet (600 mm) wide is in contact with the pavement surface while the drag is operated.
2. The condition of the drag shall be maintained so the resultant surface is of uniform appearance with corrugations approximately 1/16 inch (2 mm) in depth. Drags shall be maintained clean and free of encrusted mortar. Drags that cannot be cleaned shall be discarded and replaced.
3. The carpet shall meet the following requirements:
    a. Facing Material - Molded polyethylene pile face
    b. Blade Length - 7/8", ±1/8" (22 mm, ±3 mm)
    c. Total Fabric Weight - 70 oz. Per square yard min.
    d. (2.37 kg per square meter min.)
4. The backing shall be of a strong, durable material, not subject to rot, which is adequately bonded to the facing.
5. Brooming may be used on irregular areas in lieu of the carpet drag and tine finish. The broom shall be drawn transversely across the pavement with adjacent strokes slightly overlapping.
6. Brooming shall be uniform in appearance and shall produce grooves 1/16 inch (2 mm) deep. Texturing shall be completed while the concrete surface can be broomed without being torn or unduly roughened by the operation.
7. The finished surface shall be free from rough and porous areas, irregularities, and depressions resulting from improper handling of the broom.

3.08 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas:

1. Repair and patch defective areas with cement mortar immediately after the removal of the forms but only after the Engineer has inspected the defective area.

2. Cut out honeycomb, rock pockets, voids over ½-inch diameter and holes left by tie rods and bolts, down to solid concrete, but, in no case, to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the Engineer.

3. For exposed-to-view surfaces blend white Portland cement and standard Portland cement so that when dry the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

4. Fill holes extending through concrete by means of a plunger type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

B. Repair of Formed Surfaces:

1. Repair exposed-to-view formed concrete surfaces where possible that contain defects which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the Engineer. Surface defects as such include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolts; fins and other projections on the surface, and stains and other discolorations that cannot by removed by cleaning.

2. Repair concealed formed concrete surfaces where possible that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects as such include cracks in excess of 0.01 in. wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts and spalls except minor breakage at corner.

C. Repair of Unformed Surfaces:

1. Test unformed surfaces such as monolithic slabs for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.

2. Test unformed surfaces sloped to drain for trueness of slope in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finished unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects as such include crazing, cracks in excess of 0.01-inch wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.

5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

6. Repair defective areas except random cracks and single holes not exceeding 1-inch diameter by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least ¾-inch clearance all around. Dampen all concrete surface in contact with patching concrete and brush with a neat cement grout coating or use concrete bonding agent. Place concrete before grout takes its initial set. Mix patching concrete of the same materials to provide concrete of the same type of class as the original adjacent concrete. Place, compact, and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

7. Repair isolated random cracks and single holes not over 1-inch in diameter by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen all cleaned concrete surfaces and brush with neat cement grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack consisting of 1-part Portland cement to 2-½ parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patch areas continuously moist for not less than 72 hours.

8. Repair methods not specified above may be used subject to the acceptance of the Engineer.

3.09 SURFACE TEST AND TOLERANCES

A. Ten Foot Straightedge: The concrete surface shall be tested with a 10-foot straightedge. The permissible longitudinal and transverse surface deviation shall be 1/8-inch in 10 feet.

B. Areas where the maximum deviation exceeds the permissible deviation by not more than 3/8 inch will be subject to the following at the discretion of the Engineer.

   1. Grind down to an elevation where the area or spot will be within the permissible deviation.

   2. Accept affected area without corrective action with price reduction at a rate noted below.

C. Areas where maximum deviation exceeds the permissible by more than 3/8 inch will be subject to the following at the discretion of the Engineer.

1. Grind down to an elevation where the area or spot will be within the permissible deviation.
2. Accept affected area without corrective action with price reduction at a rate noted below.
3. Satisfactorily remove and replace deficient area.

D. Grinding shall be accomplished with specially prepared circular diamond blades mounted on a horizontal shaft. Areas that have been ground shall not be left smooth or polished, but shall have a uniform texture equal in roughness to the surrounding unground concrete.

E. If the Engineer accepts the deficient area without correction, a price reduction at the following rates will be deducted from the contract.

1. Ten dollars per square yard for those areas where the maximum deviation exceeds the permissible deviation by not more than 1/8 inch.
2. Twenty dollars per square yard for those areas where the maximum deviation exceeds the permissible deviation by more than 1/8 inch but not more than 3/8 inch.
3. Thirty dollars per square yard for those areas where the maximum deviation exceeds the permissible deviation by more than 3/8 inch.

F. Measurements for determining the limits of deficient areas will be made in the following manner:

1. The length of the deviation will be that length out of specification tolerance at the location of the surface test as checked with a 10-foot straightedge and a 1/8-inch shim.
2. Where the transverse surface test is out of specification, the maximum length and maximum width at a particular site shall be used in computation of the area.

3.10 DEFECTIVE WORK

A. Concrete work, which does not conform to the specified requirements, including strength, tolerances, and finishes, shall be corrected at the Contractor's expense without extension of time therefore. The Contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

* * * END OF SECTION * * *

DIVISION 31 - EARTHWORK

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SECTION 31 23 00 - EXCAVATION AND FILL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, if attached, apply to the work specified in this section.

B. Related Work Specified Elsewhere:

1. Watering for Embankments - Section 31 23 11
2. Aggregate Base Course - Section 32 11 23

1.02 DESCRIPTION OF WORK

A. The Work covered by this section of the specifications shall consist of furnishing all plant, labor, and equipment, appurtenances and material, and of performing all operations in connection with the excavation, embankment, compaction, topsoiling, and grading required for the project, in accordance with these specifications and in conformity with the dimensions and typical sections shown on the plans and with the lines and grades established by the Engineer.

B. The Owner's representative will provide the initial and final grade stakes as discussed in Section 01 32 23. The Contractor shall be responsible for providing all interim slope and grade staking and other staking as may be necessary to complete construction.

1.03 CLASSIFICATION OF EXCAVATION

A. "Unclassified Excavation" shall include all excavation performed under this section regardless of the material encountered.

1.04 QUALITY ASSURANCE

A. During the construction of the subgrade, a representative of the Owner shall be on site to allow for the examination of the exposed subgrade.

B. In-place density tests will be taken, by the Owner's representative, on each layer of the subgrade and base at an approximate rate of 1 test per 10,000 square feet or as deemed necessary by the Engineer.

C. The Contractor will conduct additional soil tests and quality control testing as desired for his own information and use. The Contractor shall have submitted directly to the Engineer with copies to the Owner, three (3) copies of all field and laboratory tests and reports of inspections performed by him or his agents.

D. All grades shall be finished to within 0.1 feet of the final elevations as staked by the Owner's authorized representative.

PART 2 PRODUCTS

2.01 CONTRACTOR FURNISHED TOPSOIL

A. Contractor shall furnish screened topsoil for the project.

PART 3 EXECUTION

3.01 GENERAL

A. The excavation shall be carried to the elevations or depths required to obtain the specified depths as shown on the plans. Should the Contractor, through negligence or other fault, excavate below the designated lines or elevations, he shall replace the excavation with suitable materials and properly compact and control the moisture content in a manner as specified herein under "Formation of Embankments". All replacement work shall be at the Contractor's expense.

B. The Contractor shall inform and satisfy himself as to the character, quantity, and distribution of all material to be excavated. No payment will be made for any excavated material which is used for purposes other than those designated. All spoil areas shall be leveled to a uniform line and section and shall present a neat appearance before project acceptance.

C. Those areas outside of the embankment areas in which the top layer of soil material becomes compacted due to hauling or to any other activity of the Contractor shall be scarified and disced to a depth of 4 inches as directed to loosen and pulverize the soil.

D. If it is necessary to interrupt existing surface drainage, sewers, or under drainage, conduits, utilities, or similar underground structures, or parts thereof, the Contractor shall be responsible for and shall take all necessary precautions to protect and preserve or provide temporary service. When such facilities are encountered, the Contractor shall notify the Engineer. The Contractor, at his own expense, shall satisfactorily repair all damage to such facilities or structures which may result from any of his operations during the period of the contract.

E. The Contractor shall supervise the excavation, moving, placing, and deposition of all material and shall, with the assistance of the Engineer and/or his representative, determine the suitability of materials to be placed in embankments. All material determined to be unsuitable and all excess shall be disposed of in the appropriate areas as shown on plans, or in the outer portions of the embankments.

F. Topsoil shall not be used directly below any areas to receive surfacing.

3.02 STRIPPING

A. All vegetation such as brush, heavy sods, heavy growth of grass, decayed vegetation, rubbish, roots, and any other unsuitable material within the area to which excavation is to occur, or upon which embankment is to be placed, shall be cleared, stripped, grubbed, and disposed of, before the excavation of suitable materials or a formation of embankment is started.

B. In no case shall such objectionable material be allowed in or under the subgrades for any areas to receive surfacing.

C. All depressions or holes below the ground surface, whether caused by grubbing or otherwise, shall be backfilled with suitable material and compacted to the ground surface elevation or up to twelve (12) inches below the proposed final subgrade elevation before the construction of the embankment will be permitted to start.

3.03 EXCAVATION OF SUITABLE MATERIAL

A. Excavation shall be performed to the lines, grades, and elevations as indicated in the plans or as directed by the Engineer and shall be made so that the requirements for formation of embankments and floor can be followed. No excavation or stripping shall be started until the Engineer has taken cross sectional elevations and measurements of the existing ground surface and has provided control stakes for the proposed work. During the process of excavation, the grade shall be maintained so that it will be properly drained at all times. Temporary drains and drainage ditches shall be installed to intercept or divert all surface water which may affect the work.

B. The suitable excavation material shall be handled in such a manner as to allow the material to be properly placed and compacted in the fill areas.

C. The Contractor shall make the distribution of the excavated material as indicated in the plans. Widening or narrowing of the section and raising or lowering of the grade to avoid haul will not be permitted. The right is reserved by the Engineer to make minor adjustments or revisions in lines or grades if found necessary as the work progresses to obtain satisfactory construction.

D. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the top eight (8) inches of the subgrade or embankment.

E. All cut-and-fill slopes shall be uniformly dressed to the slope, cross section, and alignment as shown in the plans.

F. No payment or measurement for payment will be made for suitable materials removed, manipulated, and replaced in order to obtain required density. Any removal, manipulation, aeration, replacement, and recompaction of suitable materials necessary to obtain the required density shall be considered as incidental to the excavation and embankment operations and shall be performed by the Contractor at no additional compensation.

3.04 STOCKPILING

A. If at the time of excavation it is not possible to place any material in its proper section of the permanent construction, it shall be stockpiled in approved areas for later use at no extra cost to the Owner.

B. The stockpiled material shall be handled and placed as specified in the section of these specifications covering excavation, embankment, and topsoil.

C. Stockpiles of topsoil or any other material shall be located within the project limits as near the final placement site as practicable. When stockpiling within the project limits is not possible, it shall be the Contractor's obligation to arrange for and maintain stockpile sites at his own expense. Stockpiles of topsoil shall not be placed within 50 feet of embankment areas and shall not be placed on areas which subsequently will require any excavation or embankment.

D. Prior to Completion of the Work, the Contractor shall obtain and furnish to the Owner a lien waiver or a letter of satisfaction written by the owner of the stockpile area property and addressed to the Contractor.

3.05 EXCESS EXCAVATION

A. When the volume of excavation exceeds that required to construct the embankments to the

grades indicated, the excess shall be used to grade the areas of ultimate development or hauled off-site by the Contractor, subject to the approval of the Engineer and the Owner. In general, suitable excess excavation will be hauled off-site by the Contractor.

B. If it is necessary to dispose of any material, it shall be disposed of in such a manner as to present a neat appearance and to not obstruct proper drainage or cause damage to abutting property.

3.06 PREPARATION OF EMBANKMENT AREA

A. Prior to the placement of any fill material beneath the proposed street/parking lot/concrete sidewalk or paver area, the entire layer of topsoil upon which the embankment is to be placed, except where limited by solid rock, shall be removed for its entire depth to the bottom of the natural existing topsoil.

B. **A minimum of six (6) inches of material below the bottom of the natural existing topsoil or to the depth as previously described shall be scarified for the entire width of the subgrade embankment.** The area shall be scarified in furrows uniformly spaced so that at least 50% of the surface will be broken to the required depth. All roots, debris, large stones, or objectionable material that would cause interference with the compaction of the foundation for fill shall be removed from the area and disposed of as specified.

C. After removal and scarifying of the topsoil and other material under the embankment areas, the area should be examined by the Contractor for the existence of unsuitable materials. The Contractor shall notify the Engineer if he feels that unsuitable materials exist. The volume of unsuitable material shall be determined by cross sectioning the area before and after removal. The area of unsuitable material shall be removed to a depth as shown in the plans or as directed by the Owner's representative. The area shall be filled and compacted in accordance with "Formation of Embankments".

D. A thin layer (approximately 3 inches) of the fill material shall then be uniformly spread over the scarified foundation and the whole area compacted to 97% of maximum density as determined by standard proctor ASTM Test Designation D698 at a moisture content as described in the geotechnical report.

E. Except for the undercut of unsuitable materials which lie at a depth greater than six (6) inches below finished grade elevation in areas previously described, no direct payment shall be made for work performed under this section.

3.07 FORMATION OF EMBANKMENTS

A. Embankments shall be formed of satisfactory materials placed in successive horizontal layers of not more than 8 inches loose depth for the full width of the cross section.

B. The grading operations shall be conducted and the various soil strata shall be placed to produce a soil structure as shown in the typical cross section or as directed. All materials entering the embankment shall be reasonably free of organic matter such as leaves, grass, roots, and other objectionable material. Soil, granular material, shale, and any other material permitted for use in embankment shall be spread in successive layers as specified.

C. The subgrade embankments shall be constructed from the in-place non-organic soils.

D. Operations on earthwork shall be suspended at any time when satisfactory results cannot be

obtained because of rain, freezing weather, or other unsatisfactory conditions of the field. The Contractor shall drag, blade, or slope the embankment to provide proper surface drainage. Frozen material shall not be placed in the embankment nor shall embankments be placed over frozen material.

E. The material in the layers shall be of the proper moisture content before rolling to obtain the prescribed compaction. Wetting or drying of the material and manipulation when necessary to secure a uniform moisture content throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content. Sprinkling shall be done in accordance with the requirements of Section 31 23 11. Samples of embankment materials for testing, both before and after placement and compaction, will be taken. From these tests, corrections, adjustments, and modifications of methods, materials, and moisture content will be made to construct the embankment.

F. Where a large portion of the materials excavated consist of rock, the rock may be used in the construction of the embankment as hereinafter specified:

1. The maximum dimension of any rock used shall not exceed 12” maximum.
2. Rocks shall be carefully distributed throughout the embankment and imbedded with earth or other fine material so that the interstices between the large particles are filled and a dense, compact, uniform embankment is secured.
3. No rock larger than 4” in any direction will be allowed in the upper eight (8) inches of any embankment as this portion of the embankment shall be composed solely of earth or other suitable material.

G. Compaction and watering shall be continued on all areas below the proposed parking lot until it has been compacted to 97% of maximum density in accordance with ASTM D698 (standard proctor).

H. The Contractor shall be responsible for the stability of all embankments made under the contract and shall replace any portion which in the opinion of the Engineer has become displaced due to carelessness or negligence on the part of the Contractor. The Contractor shall plan his work so that the necessary compaction tests on each lift can be completed prior to placing additional lifts of material.

3.08 DIVERSION DITCHES AND DRAINAGE PROVISIONS

A. If it is necessary, in the prosecution of the work, to interrupt the natural drainage of the surface, or the flow of artificial drain, the Contractor shall provide temporary drainage facilities that will prevent damage to public or private interests and shall restore the original drains as soon as the work will permit. The Contractor shall, at his own expense, take all measures necessary to properly drain the work site. The Contractor shall be held liable for all damages which may result from neglect to provide for either natural or artificial drainage which his work may have interrupted. All temporary diversion ditches shall be of adequate size to handle any anticipated flow.

B. Diversion ditches which are to be permanent shall conform to the shape required in the plans.

3.09 TOPSOIL

A. The topsoil shall be stripped and stockpiled form the regular grading areas and placed on all disturbed areas adjacent to the recreational trail, as shown on plans.

B. All topsoil removed from the excavation areas shall be salvaged and replaced over the disturbed areas. Excess topsoil will remain the property of the Owner and will be stockpiled near the site for the Owner at no additional cost.

C. The stockpiling of topsoil shall be in accordance with the requirements of paragraph 3.04.

D. No direct payment will be made for stripping, hauling, stockpiling, or final placement of topsoil. This work is to be considered subsidiary to excavation items for which unit prices are requested.

3.10 TOLERANCES

A. The subgrade and all other graded surfaces shall be of such smoothness that it will not vary more than 0.10 of a foot from true grade as established by grade hubs. Any deviation in excess of this amount shall be corrected by loosening, adding, or removing materials, reshaping, and compacting.

3.11 WATERING FOR EMBANKMENTS

A. Refer to Section 31 23 11 - Watering for Embankments.

3.12 EQUIPMENT

A. The Contractor may use any type of earthmoving, compaction, and watering equipment he may desire or has at his disposal, provided the equipment is in a satisfactory condition and is of such capacity that the construction schedule can be maintained as planned by the Contractor and as approved by the Owner in accordance with the completion schedule specified for the construction. The Contractor shall furnish, operate, and maintain such equipment as is necessary to control uniform density, layers, section, and smoothness of grade.

3.13 HAUL

A. No payment will be made separately or directly for haul on any part of the Work. All hauling will be considered a necessary and incidental part of the Work, and its cost shall be considered by the Contractor and included in the contract price for the work involved.

* * * END OF SECTION * * *

SECTION 31 23 11 - WATERING FOR EMBANKMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work of this section.

B. Related Work Specified Elsewhere:

1. Excavation and Fill - Section 31 23 00

1.02 DESCRIPTION OF WORK

A. This item shall consist of furnishing and applying water required in the compaction of embankments and/or the clay cover, and for other purposes in accordance with the requirements of these specifications or as directed.

PART 2 PRODUCTS

2.01 WATER SOURCE

A. The Contractor shall obtain a Temporary Water Rights Permit to use water for construction, testing, or drilling purposes from the SD Department of Agriculture and Natural Resources for all water sources. Contact DANR by phone at 605 773-3352 for more information.

B. The Contractor shall be responsible to provide own source of water for construction. Contractor shall obtain all federal, state, and local permits necessary for sources provided by Contractor. Upon receipt of the permits the Contractor shall submit two copies to the Engineer for his review and approval prior to removal of any water.

C. The Contractor shall be responsible for all measures necessary to protect the health and safety of all personnel with access to the site.

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

A. Water, when required, shall be applied at the locations, in the amounts, and during the hours, including nights, as required. An adequate water supply shall be provided by the Contractor.

B. The equipment used for watering shall be of ample capacity and of such design as to assure uniform application of water in the amounts required.

C. Contractor shall provide information to Engineer on size or capacity of water vehicle used and shall provide daily load counts to the Resident Project Representative.

* * * END OF SECTION * * *

SECTION 31 23 14 - SHEETING, SHORING, AND BRACING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions shall apply to work covered in this section.

B. Related requirements specified elsewhere:

1. Structural Excavating, Filling and Grading - Section 31 23 16
2. Trenching, Backfilling and Compacting - Section 31 23 33
3. Manholes and Castings – Section 33 39 13
4. Water Utility Piping and Fittings – Section 33 11 00

1.02 DESCRIPTION OF WORK

A. Furnish and install all necessary sheeting, shoring, and bracing to adequately protect all new and existing structures, all existing piping as may be required during construction period, and all new piping.

PART 2 PRODUCTS

2.01 MATERIALS AND CONDITION

A. All sheeting, shoring, and bracing shall be in good or new condition and shall conform to the requirements of current safety codes and guidelines.

PART 3 EXECUTION

3.01 METHODS

A. All excavation shall be properly shored, sheeted, and braced to furnish safe working conditions conforming to the current codes, regulations, and guidelines; to prevent any shifting and movement of material which may endanger personnel; to prevent damage to structures, or other work; and to avoid delay to the work.

B. Bracing shall be so arranged as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength. If the Engineer is of the opinion that at any point the sheeting or supports furnished are inadequate or unsuited for the purpose, he may order additional sheeting or support to be installed. Whether so ordered by the Engineer or not, sufficient sheeting or support shall be installed to protect the work from any damage to new structures.

C. Trench sheeting shall remain in place until pipe, etc., has been laid, tested for defects, and repaired if necessary, and the earth around it compacted to a depth of one foot over the top of the pipe. Timber sheeting if used shall not be removed below an elevation of two feet above

the top of the pipe.

D. No sheeting, shoring, and bracing which is within three feet of the surface of the finished grade may be left in place without the written permission of the Engineer.

E. In general, the sheeting and bracing shall be removed as the excavation is refilled in such a manner as to avoid the caving in of the bank or disturbance to adjacent areas or structures. The voids left by the withdrawal of the sheeting shall be carefully filled by ramming or otherwise as directed. Permission of the Engineer shall be obtained before the removal of any shoring, sheeting, or bracing.

F. It shall be the duty and responsibility of the Contractor to be familiar with all local, state, and federal regulations relating to this type of work and to comply with those regulations.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. Sheeting, shoring, and bracing left in place to protect footings, structures, or piping shall be measured as part of the base bid prices if detailed on the plans.

4.02 BASIS OF PAYMENT

A. Payment for sheeting, shoring, and bracing will be allowed, if not detailed on the plans, only if ordered to be left in place by the Engineer in writing during construction.

* * * END OF SECTION * * *

SECTION 31 23 16 - STRUCTURAL EXCAVATING, FILLING, AND GRADING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions shall apply to the work covered in this section.

B. Related requirements specified elsewhere:

1. Traffic Control - Section 01 55 26
2. Clearing, Grubbing and Waste Disposal - Section 31 11 00.
3. Sheeting, Shoring and Bracing - Section 31 23 14
4. Trenching, Backfilling and Compacting - Section 31 23 33
5. Seeding and Fertilizing – Section 32 92 19
6. Existing Underground Utilities - Section 33 01 00
7. Manholes and Castings – Section 33 39 13

1.02 DESCRIPTION OF WORK

A. The work covered by this section of the specifications shall consist of furnishing all plant, labor, and equipment, appurtenances and material, and of performing all operations in connection with the excavation, filling, backfilling, and grading for all structures complete in accordance with the specifications, applicable drawings, and subject to the terms and conditions of the contract.

B. Structures shall include, but not be limited to; manholes, pond structures, and ground vaults.

C. **Structural foundations for buildings, water storage structures, and other architectural structures are not included with this specification. See project specific specifications for those items.**

D. Such excavation and backfilling as is required for the installation of piping, electrical, and mechanical work is not covered in this section but is covered in those sections related to each item.

E. The extent and performance of the excavations, filling, backfilling, and grading shall be as shown on the plans and shall comply with the requirements, codes, and guidelines of the various governing bodies and regulatory agencies.

1.03 QUALITY ASSURANCE

A. The Contractor shall obtain qualified testing and inspection services and such other independent services as may be required to assure compliance with the requirements as specified hereinafter. Certified tests of all granular materials will be provided to the Engineer prior to delivery or installation on the job site.

B. After the excavation has been completed and before any engineered fill or structures are

placed, the subgrade shall be inspected and tested by the Engineer before it is used as a foundation.

C. Moisture-density (Proctor) tests on the engineered fill materials and all in-place engineered fill field density tests shall be made as herein specified and in accordance with the General Conditions. Sufficient tests in number and location will be performed so as to assure that the engineered fill is in general compliance with the compaction requirements as specified herein.

D. The Contractor may conduct additional soil testing and quality control testing as desired for his own information and use.

1.04 SUBMITTALS

A. Three copies of the following reports shall be submitted directly to the Engineer from the testing and inspection services employed by the Contractor as per 1.03 above with copies to the Owner.

1. Material Certifications
2. Field density reports
3. Results of quality control tests
4. Inspection and observation reports
5. Verification of footing conditions and elevations

1.05 JOB CONDITIONS

A. The Contractor shall locate existing underground utilities in the areas of work. If existing utilities are to remain in place, provide adequate means of protection during earthwork operations.

B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Engineer immediately for directions as to procedure. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

C. Do not interrupt existing utilities serving facilities occupied and used by Owner or others except when permitted in writing by the Owner, and then only after acceptable temporary utility services have been provided.

D. The use of explosives on any portion of the work without prior written permission from authorities having jurisdiction is prohibited. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

E. Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

F. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1.06 CLASSIFICATION OF EXCAVATED MATERIALS

A. No classification of excavated materials will be made. Excavation and trenching work shall

include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.

*** Exception: A bid item may be provided on the bid form for the removal of unsuitable material.

PART 2 PRODUCTS

2.01 ENGINEERED FILL MATERIAL

A. The Contractor shall provide acceptable soil material where required for structural engineered fill which meets the following gradation:

MECHANICAL ANALYSIS:

SIEVE SIZE	% PASSING
3/8"	100%
#4	95-100
#8	80-100
#30	25-60
#200	0-10

B. The engineered fill material shall be non-plastic when tested in accordance with ASTM D4318.

2.02 NON-ENGINEERED FILL AND BACKFILL MATERIALS

A. The Contractor shall provide acceptable soil materials for backfill and fill which shall be non-expansive material and shall be free of clay, rock, or gravel larger than two (2) inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

B. Acceptable soil materials are defined as those materials that, in the judgment of the independent testing and inspection service, will perform as required for the intended use.

PART 3 EXECUTION

3.01 STRIPPING

A. All vegetation such as brush, heavy sod, decayed matter, rubbish and any other unsuitable material within a fill area shall be stripped or otherwise removed before the excavation or backfill is started. In no case shall such objectionable material be allowed in or under fill.

B. All dark loam shall be stripped and stockpiled to be replaced on top of the final embankments and all disturbed areas not covered by walks or pavements.

3.02 EXCAVATION

A. The sloped sides of all excavations are to comply with all local, state, and federal codes and ordinances having jurisdiction. The sides and slopes of excavations should be maintained in a safe condition until completion of backfilling. Bottom of excavation shall slope as shown on the plans.

B. Sheeting, shoring, and bracing are to be furnished and used where minimum sloping is not possible because of space restriction and stability of material.

C. Excavation shall be completed to an extent to conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction required and for inspection. Undercutting of banks will not be permitted. In excavating for footings and foundations, care shall be taken not to disturb the bottom of the excavation or over excavate. Excavate by hand, if necessary, to final grade just before concrete is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete or engineered fill. If excavations under footings are carried below the elevations shown or directed, the over excavation shall be restored to proper elevation by and at the expense of the Contractor, using approved, compacted engineered fill.

D. Where unsuitable material underlies the footing or foundation, the unsatisfactory material is to be excavated to a depth where suitable materials are found or as directed by the independent testing and inspection service, or the Engineer. All over excavation required for removal of unstable material shall be backfilled with engineered fill material. The backfill material shall be compacted equal to the density and moisture content as specified herein. Footings shall be placed at the elevations shown on the plans.

E. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. Convey water removed from excavations and rainwater to collecting or runoff areas. Provide and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

F. Stockpile suitable excavated materials until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Dispose of excess soil material and waste materials as specified.

G. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.03 COMPACTION

A. Soil compaction processes shall be controlled during construction providing for the percentage of density specified.

B. Testing methods and Density Requirements:

1. When depth of Engineered fill is greater than eight (8) inches, the Engineered Fill shall tested and compacted to not less than 97% Proctor density (ASTM D698). If depth of

Engineered Fill is less than eight (8) inches, testing will not be required unless visual observation by the Engineer warrants testing.

2. All non-engineered fill and all subgrades shall be compacted to 95% of Standard Proctor (ASTM D698). Testing will be performed under each structure to assure density requirements are attained.

C. Where subgrade or a layer of soil material must be moisture conditioned before compaction, uniformly apply water to the surface of subgrade or layer of soil material in such a manner as to prevent free water appearing on the surface during or subsequent to compaction operations. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by disking, harrowing, or pulverizing, until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests.

3.04 COMPACTION AND FILL

A. Backfill excavations as promptly as work permits but not until completion of the following:

1. Inspection and acceptance by Engineer of all construction below finish grade, including the independent inspection service, and, where applicable, damp proofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities.
3. Removal of all concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
5. Removal of trash and debris.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

B. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than one (1) vertical to four (4) horizontal so that fill material will bond with existing surface. When existing ground surface has a density less than that specified herein, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

C. Place backfill and fill materials in layers not exceeding 8 inches in loose depth. Before compaction moisten or aerate each layer as necessary to provide the optimum moisture content. Mechanically compact each layer to the required percentage of maximum density for each area classification. Compaction of structure backfill by inundation with water will not be permitted. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

D. Place all backfill and fill materials evenly adjacent to structures, to the required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.

3.05 GRADING

A. Uniformly grade areas within the limits of grading under this section, including adjacent transition areas. Smooth all finished surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:

   1. Grassed Areas: Finished areas are to receive topsoil to within not more than 0.10 feet above or below the required subgrade elevations.

   2. Walks: Shape surface of areas under walks to line, grade, and cross section with finished surface not more than 0.10 feet above or below the required subgrade elevation.

   3. Roads and Parking within Building Excavation Limits: Shape surface of areas under pavement to line, grade, and cross section with finished surface not more than 1/2 inch above or below the required subgrade elevation.

C. Grade all surfaces of fill under slabs smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of ¼-inch when tested with a 10-foot straightedge.

3.06 TOPSOIL

A. The Contractor shall remove and stockpile sufficient topsoil to surface to a minimum depth of six (6) inches, or depth as shown on the plans, all fills, embankments, and any other areas on the site of the work where the original topsoil will be covered or damaged. Topsoil shall be free from trash, debris, and surface vegetation more than two (2) inches in height.

B. Prior to the topsoiling and finish grading operations, all rough grades shall be corrected, adjusted, and repaired if required. All subgrade surfaces shall be brought to the prescribed elevations.

C. The subgrade surface shall be prepared prior to topsoil placement by being made loose and friable by cross-disking or other approved method, to a depth of two (2) inches or more to permit bonding of the topsoil to the subgrade.

D. All stones and other debris greater than two (2) inches in any dimension shall be removed from the surface of the subgrade prior to the placement of the topsoil.

E. Topsoil shall be placed and evenly spread to such thickness that the finished compacted depth of four (4) inches, unless otherwise shown on the plans, is obtained.

F. Topsoil material shall not be placed when the topsoil or subgrade is frozen or wet enough to cause clodding.

G. Topsoiling operations shall be considered complete when the finished surface of the compacted topsoil is:

   1. Free of sticks, stones, and other material of one (1) inch or more in any direction.

   2. Smooth and true to required grades with a maximum allowable deviation of 0.1 foot.

3.07 MAINTENANCE

A. Protect newly graded areas from traffic and erosion and keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather the Contractor will scarify surface, reshape, and compact to required density prior to further construction.

3.08 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Transport acceptable excess excavated material to designated areas on the Owner's property. Stockpile soil or spread as directed by Owner.

B. Remove all trash, debris, and waste materials from the Owner's property and dispose of at an approved landfill.

3.09 SETTLEMENT

A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments that may occur within the correction period stipulated in the General Conditions.

B. The Contractor shall make, or cause to be made, all repairs, or replacements made necessary by settlement within thirty (30) days after notice from the Engineer or Owner.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. Structural excavation, filling, and grading will not be measured for direct payment and will be considered incidental work pertaining to the contract. No direct compensation will be made for this work.

4.02 BASIS OF PAYMENT

A. Structural excavation, filling, and grading will be considered incidental work pertaining to the contract. No direct compensation will be made for this work.

* * * END OF SECTION * * *

SECTION 31 23 33 - TRENCHING, BACKFILLING, AND COMPACTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the work covered in this Section.

B. Related Requirements specified elsewhere:

1. Traffic Control - Section 01 55 26
2. Sheeting, Shoring and Bracing - Section 31 23 14
3. Structural Excavating, Filling and Grading - Section 31 23 16
4. Curbs, Gutters, Sidewalks and Driveways - Section 32 16 00
5. Existing Underground Utilities - Section 33 01 00
6. Water Utility Piping and Fittings – Section 33 11 00

1.02 SCOPE

A. This section covers the excavation of all necessary trenching for underground utilities and backfilling same after the pipe and related material has been properly laid, inspected and tested all in accordance with applicable federal, state and local laws and regulations.

1.03 QUALITY ASSURANCE

A. The Contractor shall obtain qualified testing and inspection services and such other independent services as may be required to assure compliance with the requirements as specified hereinafter. Certified tests of all granular materials will be provided to the Engineer prior to delivery or installation on the job site.

B. Moisture-density (Proctor) tests on the engineered fill materials and all in-place engineered fill field density tests shall be made as herein specified and in accordance with the General Conditions. Sufficient tests in number and location will be performed so as to assure that the engineered fill is in general compliance with the compaction requirements as specified herein.

C. The Contractor may conduct additional soil testing and quality control testing as desired for his own information and use.

D. When requested by the Engineer or Resident Project Representative, the Contractor shall excavate and expose the pipe previously laid at any point.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL EXCAVATION

A. All material encountered shall be excavated to the lines and grades as shown on the plans, set by the Engineer or as specified herein.

B. Unless otherwise shown on the plans, trenches for watermain shall be of a depth that will provide the following minimum covers over the top of the pipe as measured from the original ground surface.

   1. Minimum cover for all watermain shall be seventy-eight (78) inches.

C. Where pipe elevation is determined by minimum depth only, the excavation shall be sufficient at all points to grade the pipes on the tangents and vertical curves as dictated by the minimum bending radius of the pipe and fittings as recommended by the manufacturers.

D. The trenches shall be sufficiently straight between designated angle points to permit the pipe to be laid true to line in the approximate center of the trench.

E. Intersections with and crossings of other underground utilities shall be as shown on the plans and/or in accordance with applicable state and local laws and regulations. Refer to Section 33 01 00 for additional requirements.

F. All excavated material suitable for backfilling shall be placed in an area away from the trench edges so as to avoid overloading, sliding, and cave-ins.

G. The areas immediately adjacent to the trench shall be graded as required to prevent surface water from entering the trenches.

3.02 EXCAVATION FOR APPURTENANCES

A. A minimum of twelve (12) inches shall be left between the trench wall and the outside surface of the appurtenance.

3.03 SHEETING, SHORING AND BRACING

A. Refer to Section 31 23 14 of these specifications

3.04 ROAD, STREET, AND DRIVEWAY CROSSINGS

A. At such road and all other crossings as may be designated by the Engineer, the trenches are to be mechanically tamped and filled in such a manner as to prevent any serious interruption of traffic upon the roadway or crossing.

B. Not more than one street crossing may be obstructed by the same trench at any one time except by permission of the Engineer and Owner.

3.05 ROCK EXCAVATION

A. Rock excavation shall be completed to a minimum of eight (8) inches below and on each side of all pipes, valves, fittings, and other appurtenances.

B. Excess excavation shall be backfilled with compacted material conforming to the bedding material required for the material being used.

3.06 DEWATERING

A. Where water is encountered in a trench, water shall be removed by pumping to lower the water level to such elevation that the pipe may be laid dry at the grade shown on the plans.

B. All water pumped from the trench shall be disposed of in a manner so as not to cause any

damage to adjacent property.

C. When dewatering is paid for, it shall be considered as dewatering only when a manifold or pump and system of well points is installed to lower ground water such that excavation and construction can take place.

D. The process of pumping water out of the trench with a suction hose and pump will not be considered as dewatering.

E. Where seepage of water into the trench occurs that can be removed using standard pumping procedures, it shall not be deemed sufficient cause for installing a system of manifolds and well points and classified as dewatering in order to obtain remuneration under the Bid Item - Dewatering.

F. A dewatering permit is required when the discharge from dewatering may reach the waters of the state. To obtain information on the General Dewatering Permit, the Contractor should contact the Department of Environment and Natural Resources at (605) 773-3351.

3.07 TRENCH BOTTOM PREPARATION

A. The sides of all trenches shall be vertical from the bottom of the trench to a point one (1) foot above the top of the pipe.

B. The width of the trench shall be a minimum of twelve (12) inches on each side of the pipe bell.

C. The bottom of all trenches for underground piping shall be carefully and accurately formed to the lines and grades as shown on the plans, set by the Engineer or as specified herein.

D. Rock, boulders, and large stones, or other manmade material shall be removed to provide a clearance of at least eight (8) inches below the outside barrel of the pipes, valves, fittings appurtenances. Adequate clearance for properly jointing pipe laid in rock trenches shall be provided at bell holes. The space between the rock at the bottom of the trench and the bottom of the pipe barrel shall be filled with compacted bedding material.

E. If the trench bottom is inadvertently excavated deeper than necessary, it shall be backfilled to the proper grade with compacted bedding material.

3.08 UNSTABLE TRENCH BOTTOM

A. Whenever wet, soft or unstable soils incapable of properly supporting the pipe, or other appurtenances are encountered in the trench, the Contractor shall be required to remove the unsuitable materials and backfill to the proper grade with concrete, granular material or other suitable approved material.

B. Backfill material shall be compacted to provide a firm and level support for the piping system. Firm support is defined as no visual deformation in the surface when workers walk on the compacted material.

3.09 BACKFILLING AND COMPACTING

A. Any trenches improperly backfilled or showing excessive settlement shall be reopened to a depth required for proper compaction.

B. Backfill material shall be free of boulders, frozen clods, large roots, excessive sod or other vegetation, construction debris.

C. No backfilling shall take place in freezing weather without written permission from the Engineer.

D. Borrowed granular bedding material shall conform to the gradation indicated below.

Sieve Opening	Bedding Material (Percent Passing)
1 ½”	95-100
No. 200	< 15

E. Bedding material excavated from the job site shall be finely divided material free from organic material and clods, lumps of frozen material or stones larger than 1 1/2" in maximum diameter. Bedding material shall be of proper moisture content to form a firm bed for the pipe.

F. The bedding material backfilling around the pipe shall be deposited in layers not to exceed eight inches (8") and carefully compacted to a degree of compaction at least equal to 90% maximum dry density as determined by Standard Proctor Test, ASTM Test Designation D698 throughout the entire depth of each layer. Where the pipe has a protective coating, care shall be taken not to damage the coating.

G. The embedment material shall be finely divided material free from debris, organic material, and clods, lumps or stones larger that 1-1/2 inches maximum diameter. The material shall be borrowed material or job site excavated material. Embedment material shall be placed in uniform layers not more than twelve (12) inches thick and compacted to 90% maximum density as determined by ASTM D698 until the pipe has a cover of not less than one (1) foot.

H. The remainder of the backfill shall consist of selected material from excavation or borrow, and shall be free from cinders, ashes, refuse, organic and frozen material, boulders or other materials that are unsuitable. Stones larger than 3 inches in diameter shall not be placed within two feet of the top of the pipe. This material shall be placed from 12 inches above the top of the pipe to 6 inches below the ground surface, unless otherwise specified, or to the subgrade elevation for streets or paved surfaces.

I. After completing the bedding and embedment of the pipe as specified above, the remainder of the backfill material beneath unpaved areas shall be placed in uniform layers not exceeding one (1) foot and tamped. It shall be the Contractor's responsibility to compact each layer throughout its entire depth to a degree of compaction at least equal to that of the surrounding earth. The Contractor shall moisten or aerate the backfill material to obtain the required compaction. The Contractor shall provide a final cover of topsoil as specified herein. Any additional settlement of the trench shall be brought back to grade with additional topsoil. The trench shall be left in a condition so as to present a neat appearance.

J. Open trenches under road surfacing, sidewalks, curb and gutter, and other adjacent improvements to a point eight (8) feet from the edge of the road surface and as otherwise noted on the plans shall be backfilled with uniform layers not exceeding one (1) foot. Each layer, except the upper 6 inches of subgrade underlying the pavement, shall be spread uniformly and tamped with a hand tamper or other approved device until thoroughly

compacted to at least 90% of the maximum density obtainable at optimum moisture content. The upper 6-inch layer, forming the subgrade for surfacing shall be compacted to at least 95% of the maximum density obtainable at optimum moisture content. Density of backfill shall be determined based on Standard Proctor Test, ASTM Test Designation D698.

3.10 TESTING REQUIREMENTS

A. Frequency of Testing: Minimum of one (1) test every 250 feet to 350 feet of trench per lift or as directed by Engineer. Frequency of testing may be altered by Engineer after adequate testing is completed to determine level of effort by Contractor is sufficient. When frequency is altered by the Engineer, random testing will be performed to verify compaction efforts. The Contractor may be required to excavate to depths required by Engineer for testing and backfill test holes to density specified.

B. Retesting: In the event of failure to meet compaction criteria, the Contractor shall re-excavate and re-backfill at direction of Engineer. All retesting to be paid for by Contractor and to be performed by soils testing firm secured by the Contractor and approved by the Engineer.

3.11 EXCESS EXCAVATION

A. The Contractor shall be responsible for securing and maintaining an adequate area where excess excavation can be stockpiled for future use or wasted.

B. The Engineer's approval on the site selection shall be required.

C. The Contractor shall be responsible for the final cleanup of the site chosen. The site shall be cleaned to the satisfaction of the property owner, and a lien waiver or a letter of satisfaction written by the property owner and addressed to the Contractor shall be obtained by the Contractor and furnished to the Owner.

3.12 TOPSOIL

A. Pasture or native grasslands or other areas designated on the plans shall be reseeded to the full width and length of areas disturbed during construction.

B. Prior to topsoiling and finish grading, all rough grades shall be corrected, adjusted, and brought to the required elevations.

C. The subgrade surface shall be prepared for topsoiling by cross disking to a depth of two (2) inches or more to permit bonding of the topsoil to the subgrade.

D. All stones and other debris greater than two (2) inches in any dimension shall be removed from the surface of the subgrade prior to the placement of the topsoil.

E. Topsoil material shall not be placed when the topsoil or subgrade is frozen or wet enough to cause clodding.

F. Topsoiling operations adjacent to lagoons and along piping routes shall be considered complete when the finished surface is:

1. Free of sticks, stones and other material one (1) inch or more in any dimension.
2. Smooth and true to required grades with a maximum allowable deviation of 0.1 foot.

G. All lawns shall be raked with a landscape rake, garden rake, or other approved equipment to

remove all clods, stones, sticks, or other material greater than one (1) inch in any dimension. Trenches shall be slightly crowned and all disturbed areas smoothed to a maximum deviation of 0.1 foot and ready for seeding operations by Contractor prior to acceptance by the Engineer.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. Trenching, backfilling, and compacting are considered incidental work with no separate measurement and payment to be made.

B. Dewatering will not be directly measured directly and will be considered as subsidiary work pertaining to the Contract unless dewatering is specifically called for in the bid schedule. When called for in the bid schedule, the quantity given in the bid schedule is an estimate only, given to aid the Contractor in the preparation of his bid. Dewatering shall be measured in lineal feet of trench actually requiring dewatering as preapproved by the Engineer.

4.02 BASIS OF PAYMENT

A. Trenching, backfilling, and compacting are considered incidental work with no separate payment to be made.

B. Dewatering will not be directly measured for direct payment unless dewatering is specifically called for in the bid schedule. Payment for dewatering that is preapproved by the Engineer shall be paid for at the unit contract price shown on the Bid Form.

* * * END OF SECTION * * *

DIVISION 32 –EXTERIOR IMPROVEMENTS

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SECTION 32 11 23 - AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Special Conditions shall apply to work covered in this section.

B. Related requirements specified elsewhere:

1. Asphalt Concrete Surfacing - Section 32 12 16
2. Curb and Gutter and Misc. Concrete – Section 32 16 00

1.02 DESCRIPTION OF WORK

A. Base course shall be hauled, spread, compacted, and laid to grade as staked by the Owner's representative and shown on plans.

1.03 QUALITY ASSURANCE

A. The finished grade of the base course shall be within 0.05 feet at any point, as staked and checked by the Owner's Representative.

PART 2 PRODUCTS

2.01 BASE COURSE

A. The aggregate for base course shall consist of sound durable particles of gravel and sand with which may be included limited amounts of fine soil particles. The physical characteristics and quality of the materials shall conform to the specifications for the particular material required by the contract as follows:

REQUIREMENT	Aggregate Base Course
SIEVE	PERCENT PASSING
2" (50 mm)	
1" (25.0 mm)	100
3/4" (19.0 mm)	80-100
½" (12.5 mm)	68-91
No. 4 (4.75 mm)	46-70
No. 8 (2.36 mm)	34-58
No. 40 (425 µm)	13-35
No. 200 (75 µm)	3.0-12.0
Liquid Limit Max	25
Plasticity Index	0-6
L.A. Abra. Loss, max.	40
Foot Notes	1,2
Processing Required	crushed

[1] The fraction passing the No. 200 (75 µm) sieve shall not be greater than 2/3 of the fraction passing the No. 40 (425 µm) sieve. In no case shall the upper limit specified for the No. 200 (75 µm) sieve be exceeded.

[2] Requirements include quarried ledge rock.

B. Granular material of which 30% of the particles retained on the No. 4 sieve shall contain one or more fractured faces. A crushed particle shall be defined to be a fragment of stone showing at least one freshly fractured face.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. Initially, the subgrade in areas to receive new concrete or asphalt concrete paving shall be scarified to a depth of 6 inches. Contractor shall then alternately blade and roll the loosened materials, adding water where necessary, until the material is compacted to 95% of maximum density between 4% below and 4% above optimum moisture. Contractor shall then cut the subgrade to within 0.1 feet of the grade stakes provided by the Owner's representative.

3.02 BASE COURSE

A. Following the completion of the subgrade preparation, base course material, meeting the requirements as set forth in Part 2 above, shall be furnished and installed to obtain the desired grades, as shown on the plans.

B. The base course material placed under flexible pavements or surfaces shall then be compacted to 97% of Standard Proctor density (ASTM D-698) at ±3% of optimum moisture.

C. The base course material placed under rigid pavements or surfaces shall then be compacted to 97% of Standard Proctor density (ASTM D-698) at ±3% of optimum moisture.

3.03 UNSUITABLE MATERIAL

A. Unsuitable material shall be excavated and replaced with approved base course material as designated by the Owner or his Representative. No additional compensation shall be considered for this operation.

* * * END OF SECTION * * *

SECTION 32 12 13.13 - BITUMINOUS TACK COAT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions shall apply to work covered in this section.

B. Related requirements specified elsewhere:

1. Asphalt Concrete Surfacing - Section 32 12 16

1.02 DESCRIPTION OF WORK

A. This item shall consist of preparing and treating a bituminous surface with bituminous material in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

1.03 QUALITY ASSURANCE AND SUBMITTALS

A. Samples of the bituminous material that the Contractor proposes to use, together with a statement as to its source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous material to furnish material subject to this and all other pertinent requirements of the contract. Only satisfactory materials so demonstrated by service tests, shall be acceptable.

B. The Contractor shall furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of material received for use on the project.

C. Before the final estimate is allowed, the Contractor shall file with the Engineer receipted bills when railroad shipments are made, and certified weigh bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Engineer, nor shall the cart or tank be released until the final outage has been taken by the Engineer. Copies of freight bills and weigh bills shall be furnished to the Engineer during the progress of the work.

PART 2 PRODUCTS

2.01 MATERIALS

A. The bituminous material shall be either cutback asphalt, emulsified asphalt, or tar and shall conform to the requirements of Table 1. The type, grade, controlling specification, and application temperature of bituminous material to be used shall be specified by the Engineer.

TABLE 1. BITUMINOUS MATERIAL

TYPE AND GRADE	SPECIFICATION	APPLICATION TEMPERATURE	
		DEG. F.	DEG. C
Emulsified Asphalt	ASTM D977	75-130	25-55
SS-1h, CSS-1h	ASTM D2397	75-130	25-55

PART 3 EXECUTION

3.01 WEATHER LIMITATIONS

A. The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is above 60 degrees F (15 degrees C). The temperature requirements may be waived, but only when so directed by the Engineer.

3.02 EQUIPMENT

A. The Contractor shall provide equipment for heating and applying the bituminous materials.

B. The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer, pressure gages, volume-measuring devices, or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

C. A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

3.03 APPLICATION OF BITUMINOUS MATERIAL

A. Immediately before applying the tack coat, the full width of surface to be treated shall be swept with a power broom and/or air blast to remove all loose dirt and other objectionable material.

B. Emulsified asphalt shall be diluted by the addition of water where directed by the Engineer and shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before any of the overlying mixture is placed on the tacked surface.

C. The bituminous material including vehicle or solvent shall be uniformly applied with a bituminous distributor at the rate of 0.10 to 0.15 gallons per square yard (0.24 to 0.72 liters per square meter) depending on the condition of the existing surface. The type of bituminous

material and application rate shall be approved by the Engineer prior to application.

D. Following the application, the surface shall be allowed to cure without being disturbed for such period of time as may be necessary to permit drying out and setting of the tack coat. This period shall be determined by the Engineer. The surface shall then be maintained by the Contractor until the next course has been placed. Suitable precautions shall be taken by the Contractor to protect the surface against damage during this interval.

* * * END OF SECTION * * *

SECTION 32 12 16 - ASPHALT CONCRETE SURFACING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions shall apply to work covered in this section.

B. Related requirements specified elsewhere:

1. Bituminous Tack Coat – Section 32 12 13.13

1.02 DESCRIPTION OF WORK

A. The work covered under these specifications shall include the furnishing of all labor, materials, and equipment necessary to lay a compacted asphalt concrete mat (at the thickness shown on the plans), complete in place, as specified herein.

1.03 SUBMITTALS

A. The Contractor shall submit for review copies of all certificates from the manufacturer that the materials meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. The contractor shall provide the required control tests of the mineral aggregate for the asphalt surfacing. The cost is considered incidental to the project.

B. The contractor shall provide the required job mix, prepared by an independent testing laboratory approved by the Engineer for the Class E, Type 1 Asphalt concrete to the Engineer/Owner 14 days prior to start of production. The cost of the job mix designs shall be paid for by the Contractor and are considered incidental to the project.

C. Following the Engineer's approval of the above-mentioned tests, all remaining tests shall be performed by the Owner's representative with results being given to both the Contractor and the Owner.

PART 2 PRODUCTS

2.01 GENERAL

A. Specifications to be used for this section shall be the South Dakota Department of Transportation Standard Specifications for Roads and Bridges, 2015 Edition, Division III Materials Details with the following modifications, and/or special provisions.

1. Where the term Engineer, Area Engineer, Department, etc., is used it shall be replaced with Helms and Associates, Owner etc. as applicable.

2. The shale content or other particles of low specific gravity (less than 1.95) passing the

No. 4 sieve shall not exceed four (4) percent.

2.02 ASPHALT CONCRETE

A. The construction requirements and material handling shall conform to the requirements of Section 320.3, Section 880, and Section 890 of the South Dakota Department of Transportation Standard Specifications for Roads and Bridges, 2015 edition.

B. The asphalt material shall be PG 64-28.

C. Mineral aggregate for asphalt concrete shall conform to the requirements of the SDDOT standard specifications for Class E, Type I. The asphalt cement shall be PG 58-28. The Contractor shall provide a job mix formula with the supporting mix design data prior to production.

D. A bituminous tack coat (SS-1H or CSS-1H) shall be applied between each lift at a rate of 0.10 to 0.15 gallon per square yard.

PART 3 EXECUTION

3.01 GENERAL

A. The construction requirements and material handling shall conform to the requirements of Section 320.3, Section 880, and Section 890 of the South Dakota Department of Transportation Standard Specifications for Roads and Bridges, 2015 Edition, except as modified hereinafter.

1. Where the term Engineer, Area Engineer, Department, etc. is used it shall be replace Helms and Associates, Owner etc. as applicable.

3.02 ASPHALT CONCRETE SURFACE

A. Asphalt concrete surfaces will be placed in the areas as designated by the Owner and Engineer.

B. Placement of asphalt concrete surfaces shall be on compacted granular base course (at a thickness as indicated in the plans). The compacted thickness of asphalt concrete shall be as shown on the plans or as directed by the Owner and Engineer.

3.03 GENERAL

A. The Asphalt Concrete Paving equipment, weather limitations, job mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

3.04 MIXING ASPHALTIC CONCRETE MATERIALS

A. Provide hot plant-mixed asphaltic concrete paving materials.

1. Temperature leaving the plant: 143 degrees C(290 degrees F) minimum, 160 degrees C(320 degrees F) maximum.

2. Temperature at time of placing: 138 degrees C(280 degrees F) minimum.

3.05 SUBGRADE

A. Shape to line and grade and compact with self-propelled rollers.

B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.

C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.

D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.

3.06 BASE COURSES

A. Spread and compact to the thickness shown on the drawings.

B. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.

C. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.

D. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").

E. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet).

F. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

3.07 PLACEMENT OF ASPHALTIC CONCRETE PAVING

A. Remove all loose materials from the compacted base.

B. Receipt of asphaltic concrete materials:

1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280 degrees F.

2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 50 degrees F, not during fog, rain, or other unsuitable conditions.

C. Spreading:

1. Spread material in a manner that requires the least handling.

D. Rolling:

1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown own the drawings.

2. Roll in at least two directions until no roller marks are visible.

3. Finished paving smoothness tolerance:

a. No depressions which will retain standing water.

b. No deviation greater than 3mm in 1.8m (1/8" in six feet).

3.08 FINAL CLEAN-UP

A. Remove all debris, rubbish, and excess material from the work area.

* * * END OF SECTION * * *

SECTION 32 16 00 – CURB AND GUTTER AND MISC. CONCRETE PAVEMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.

B. Related requirements specified elsewhere:

1. Structural Excavating, Filling, and Grading - Section 31 23 16
2. Trenching, Backfilling and Compaction - Section 31 23 33
3. Asphalt Concrete Surfacing – Section 32 12 16

1.02 SCOPE

A. This section covers the labor, materials, equipment and related services necessary to install or repair concrete curbing/pavement and related structures damaged during construction.

1.03 QUALITY ASSURANCE

A. The Contractor shall be responsible for obtaining the services of a qualified testing firm as may be required to assure compliance with the requirements of these specifications.

1.04 SUBMITTALS

A. A complete description of the materials to be used in the Work covered by this Section of the specifications shall be submitted to the Engineer for review.

B. Three (3) copies of all reports and test results completed by the independent testing service shall be submitted directly to the Engineer.

PART 2 PRODUCTS

2.01 CONCRETE

A. See Division 030000.

PART 3 EXECUTION

3.01 GENERAL

A. Placement of concrete or asphalt on frozen surfaces will not be permitted.

B. Concrete surfaces shall be cured and protected for a sufficient period of time (not less than 3 days) to prevent damage to concrete and insure required compressive strength requirements.

3.02 CONCRETE PAVEMENT

A. Concrete Pavement, including fillets and valley gutters, shall be replaced at locations designated by the Engineer, reinforced concrete placed on compacted gravel base. Concrete and Base thickness as shown on the plans.

B. The surface of the new concrete pavement shall be finished with a light broom finish.

C. Contraction joints shall be provided at intervals of not more than ten (10) feet. When patching into existing concrete, new concrete shall have contraction joints matching existing saw joints or contraction cracks. Contraction joints shall consist of a groove of at least one third (1/3) the depth of the pavement sawed in green concrete or a plane of weakness formed by inserting a removable metal template.

D. **All expansion and contraction joints shall be filled flush to the surface with joint sealing compound. The joint sealing compound shall be finished slightly concave, and shall not be allowed to overflow the joint.**

E. Reinforcement shall consist of #4 deformed rebar placed as indicated in the plans.

3.03 CONCRETE SIDEWALK, CURB AND GUTTER OR STRAIGHT GUTTER

A. Contraction joints shall be provided at intervals of not more than 10 feet. If linear concrete with a width less than 10ft then the concrete will be saw cut to create square panels. Contraction joints shall consist of a groove at least 1-1/4 inches deep sawed in the green concrete or a plane of weakness formed by inserting a removable metal template.

B. All exposed edges of curbs and gutters shall be rounded with a suitable edging tool. Exposed surfaces shall be finished smooth and even with a steel trowel, and then given a light broom finish.

* * * END OF SECTION * * *

SECTION 32 31 13 - CHAIN LINK FENCING AND GATES

PART 2 GENERAL

2.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions shall apply to the work covered in this section.

2.02 DESCRIPTION OF WORK

A. This work consists of furnishing and erecting chain link wire mesh fence, gates, and related hardware.

PART 3 MATERIALS

3.01 TYPE I OR II STEEL PIPE

A. Type I framework shall consist of schedule 40 steel pipe with 1.8 ounces of zinc coating per square foot of surface area. The zinc coating shall be in conformance with ASTM F-1083.

B. Type II framework shall consist of pipe manufactured from steel conforming to ASTM A-569, which is cold-formed, high frequency, or induction welded and having minimum yield strength of 50,000 psi. The external surface shall be triple coated as per ASTM F-1234, Type B & Type D with 1.0 ounce ±0.1 ounce of zinc per square foot, 30 ±15 micrograms of chromate per square inch and high performance polymer. The coating shall demonstrate the ability to resist 1,000 hours of exposure to salt spray with a minimum of 5% red rust in a test conducted in accordance with ASTM B-117. Internal surface coatings shall consist of a zinc-rich based organic coating having a 915 zinc powder loading capable of providing the ability to withstand 650 hours of exposure to salt fog with a maximum of 5% red rust, when conducted in accordance to ASTM B-117.

C. All coatings shall be applied inside and out after welding of seams.

D. Pipe shall be straight, true to section and conform to the following weights:

Pipe Size O.D.	Type I Weight (lbs/ft)	Type II Weight (lbs/ft)
1 5/8”	2.27	1.84
2"	2.72	2.28
2 ½”	3.65	3.12
3"	5.79	4.64
3 ½”	7.58	5.71
4"	9.11	6.56
6 5/8”	18.97	-----

E. Fence Posts shall be of the sizes specified below:

Fabric Height	Type I or II	
	Line Posts O.D.	Terminal Posts O.D.
6’ w/ Slats	2 ½"	3"

F. Gate posts shall be of the sizes specified below:

Single Gate Width	Double Gate Width	Post O.D. Type II
Up to 6'	Up to 12'	3"
7' to 12'	13' to 25'	4"
<12’	<25’	6-5/8”

G. Rails and braces shall be minimum diameter of 1-5/8" O.D. Top rail may be SS-20, 1.46 pounds/LF, with swedged ends due to curvature of fence.

3.02 CHAIN LINK FABRIC

A. Zinc coated fabric shall be galvanized after weaving with a minimum of 1.2 ounces of zinc per square foot of surface area and conform to ASTM A-392, Class I. Fabric shall be 9-gauge wire woven in a 2" diamond mesh. The top selvage shall be twisted and barbed and the bottom selvage shall be knuckled.

B. Aluminum coated fabric shall be manufacture in accordance with ASTM A-491 and coated before weaving with a minimum of 0.4 ounces of aluminum per square foot of surface area. The steel wire and coating shall conform to ASTM A-817. Fabric shall be 9-gauge wire woven in a 2" diamond mesh. The top selvage shall be twisted and barbed and the bottom selvage shall be knuckled.

3.03 TENSION WIRE

A. Tension wire shall be marcelled 7 gauge steel wire with a minimum coating of 0.80 ounces of zinc or 0.40 ounces of aluminum per square foot of wire surface and conforming to ASTM A-824.

3.04 WIRE TIES

A. Wire Ties shall be aluminum, 9 gauge wire, alloy 1100-H4 or equivalent.

3.05 MISCELLANEOUS FITTINGS AND HARDWARE

A. Post Caps shall be pressed steel, cast iron, or cast aluminum alloy designed to fit snugly over posts to exclude moisture. Cone style caps shall be used for terminal posts and loop style caps for line posts.

B. Rail and brace ends shall be pressed steel, cast iron, or cast aluminum alloy and shall be cup-shaped to receive rail and brace ends.

C. Top rail sleeves shall be expansion type tubular steel with a minimum thickness of 0.051 inches and 7 inches in length.

D. Tension bars shall be steel strips a minimum of 5/8 inches wide and 3/16 inches thick.

E. Tension bands shall be pressed steel with a minimum of 14-gauge thickness and 3/4 inch width.

F. Brace bands shall be pressed steel with a minimum of 12-gauge thickness and 3/4 inch width.

G. Truss rods shall be a minimum of 3/8-inch diameter steel rod of merchant quality with a turnbuckle.

3.06 GATES

A. Chain link gates shall have a frame assembly with a minimum 2" O.D. pipe with fabric to match fence. All materials shall be of the same grade materials as the items specified for posts and fabric mesh. See plans for gate and lock details. All locks for this project shall be keyed alike.

3.07 HOG RINGS

A. Hog rings shall be steel wire of 11-gauge thickness with a minimum zinc coating of 0.80 ounce per square foot of wire surface.

3.08 **PRIVACY SLATS**

A. Fabric shall be furnished with pre-woven industrial grade HDPE privacy slates. Contractor shall ensure fence posts are suitable for the additional loading and shall upsize fence posts as necessary. Color shall be green in color. Slats shall be 1-1/2" width.

PART 4 EXECUTION

4.01 CONSTRUCTION REQUIREMENTS

A. The Contractor shall remove all debris and perform necessary excavation and backfilling prior to erecting the fence. All installation procedures shall conform to ASTM F-567.

B. Posts shall be set in concrete footings of the dimensions shown on the plans to eliminate danger of frost heaving the post, concrete in the crown-top shall not be larger than the concrete in the lower part of the footing. The top of the footing shall be 2 inches above grade and sloped to direct water away from posts.

C. Posts shall be spaced at not more than ten (10) foot intervals. In determining post spacing, measurements will be made parallel to the slope of the natural ground. Posts shall be set vertically, except at locations where it would be more satisfactory to place the posts perpendicular to the slope of the ground, as directed by the Engineer.

D. Brace gate and terminal posts back to adjacent line posts with horizontal brace rails and diagonal truss rods.

E. Pull posts and adjacent panels shall be constructed at sharp breaks in the vertical grades and at intervals of not more than five hundred (500) feet on straight runs of fence.

F. The fence fabric shall be placed on the faces of the posts, which are on the outsides of curves. On straight alignments, the fence fabric shall be placed on the faces of the posts designated by the Engineer. The bottom of the fabric shall be placed a normal distance of two (2) inches above the ground line. Over irregular ground a minimum clearance of one (1) inch and maximum clearance of six (6) inches will be permitted for a distance not to exceed eight (8) feet. Fabric shall be tied to line posts and top rails with tie wires spaced at maximum

intervals of 12 inches for posts and 24 inches for rails. The fabric shall be attached to the bottom tension wire at maximum intervals of 24 inches. The fence fabric shall be cut and each span attached independently to all corner and pull posts. Rolls of wire fabric shall be joined by weaving a single strand into each of the rolls to form a continuous mesh.

G. Tension wires shall be placed, stretched tight and secured to all posts in a satisfactory manner before fence fabric is placed. Sufficient tension shall be applied to the tension wires to allow maximum sag of one-fourth (1/4) inch between posts after the fence fabric has been attached. Temporary bracing on posts shall be provided to prevent undue stresses in the posts when tension is applied to one (1) tension wire at a time.

H. Gates shall be installed plumb, level and secure for the full opening without interference. The center stops and keepers shall be set in concrete.

PART 5 MEASUREMENT AND PAYMENT

5.01 METHOD OF MEASUREMENT

A. Chain link fence will be measured by the linear foot parallel to the ground, inclusive of the end, corner and pull post panels.

B. Gates will be measured on a per each basis for each size of gate listed in the bid form.

5.02 METHOD OF PAYMENT

A. Chain link fence will be paid for at the contract unit price per linear foot, inclusive of end, corner and pull post panels.

B. Chain link gates will be paid for at the contract unit price per each size of gate provided.

C. Payment for the individual items listed above will be full compensation for furnishing materials, labor, tools and equipment necessary; excavation, backfilling, concrete footings, miscellaneous hardware; electrical service, connections, and fittings; smoothing the irregularities of the ground at the fence site; clearing the line for the fence; and disposing of debris.

* * * END SECTION * * *

SECTION 32 92 19 - SEEDING AND FERTILIZING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the work covered in this section.

B. Related Work specified elsewhere:

1. Excavation and Fill – Section 31 23 00
2. Structural Excavating, Filling, and Grading – Section 31 23 16
3. Trenching, Backfilling and Compacting - Section 31 23 33
4. Water Utility Piping and Fittings – Section 33 11 00

1.02 DESCRIPTION OF WORK

A. This section covers all labor, materials, equipment, and services necessary to prepare the ground surfaces, furnish and apply fertilizer, and furnish and sow seed in those areas shown on the plans and in accordance with the specifications.

1.03 QUALITY ASSURANCE

A. All seed shall be tested by a State Seed Lab or a Commercial Seed Testing Lab within eighteen (18) months prior to the planting date. Seed not planted within the eighteen (18) month period shall be retested for dormant seed, hard seed, and germination.

B. Testing of fertilizer will not be required.

1.04 SUBMITTALS

A. Prior to the start of seeding operations, the vendor's certified analysis for the grass seed mixture shall be submitted for the Engineer's review. The information submitted shall state botanical and common name of each seed in the mixture, percentage of each by weight, percentage of purity and germination, and weed seed content.

B. During the seeding operation, the Contractor shall furnish to the Engineer the tag from each bag of seed planted. Each tag shall contain the following information: Name and address of supplier; Suppliers lot number for each kind of seed in the mixture; Purity, germination and other information required by South Seed Law for each kind of seed; Pounds of bulk seed of each kind of seed in each bag; Total pounds of bulk seed mixture in each bag; Pounds of pure live seed of each kind of seed in each bag; Total pounds of pure live seed mixture in each bag; and Dormant Seed and Hard Seed.

C. The manufacturer's certified analysis and delivery tickets for all commercial fertilizer shall be submitted stating quantity, source, and date of delivery.

D. Contractor shall submit a representative sample to the Engineer for acceptance prior to placement of mulch.

PART 2 PRODUCTS

2.01 GRASS SEED

A. Provide fresh, clean, new crop seed, complying with the tolerances for purity and germination established by the Official Seed Analysis of North America and the South Dakota Seed Law. Seed shall not exceed 1% weed content. Provide seed of the grass species and proportions as follows for all areas:

1. All Lawn Areas:

Grass Variety	**Bulk Seed (Pounds/1000 SqFt)**
Kentucky Bluegrass (Alene, Avalanche)	2.0
Perennial Ryegrass (Turf Type)	1.0
Creeping Red Fescue (Epic)	1.5
Chewings Fescue (Ambrose)	1.5
Alkali Grass (Fults, Fults II, Quill, Salty)	1.5
Total	**7.5**

2. Road Ditches, Pastures, and Other Non-Urban or Non-Wetland Areas:

Grass Species (Variety)	Pounds per Acre (Bulk)
Crested Wheatgrass (Nordan, Road Crest, Summit)	18
Western Wheatgrass (Flintlock, Rodan, Rosana, Walsh)	10
Switchgrass (Bonanza, Dacotah, Forestburg, Nebraska 28, Pathfinder, Summer, Sunburst, Trailblazer)	6
Intermediate Wheatgrass - (Chief, Clarke, Oahe, Rush)	2
Total	**36**
Winter Wheat, Rye, or Oats Temp/Cover Crop	56

A. Seed Mixtures shall meet the following minimum requirements

1. Purity 97% and Minimum Germination 85%
2. Maximum Other Crop Content 0.10% and Maximum Weed Content 0.10%

1.02 COMMERCIAL FERTILIZER

A. Apply 24-5-10 Fertilizer 50% SCU at 150 lbs per acre.

B. All fertilizer shall conform to the South Dakota Fertilizer Laws and shall be registered with the South Dakota Department of Agriculture.

1.03 FIBER MULCH

A. Fiber mulch shall be hydraulically applied at the rate of 2,000 pounds per acre on all areas seeded and other areas deemed necessary by the engineer. Fiber mulch shall be applied in a separate operation following permanent seeding and fertilizing.

B. The fiber mulch used on this project shall be one from the list below or Engineer approved equal:

Fiber Mulch	
Product	Manufacturer
Mat-Fiber Plus	Mat, Inc. Floodwood, MN Phone: 1-888-477-3028 www.matinc.biz
Conwed Hydro Mulch 2000	Profile Products LLC Buffalo Grove, IL Phone: 1-800-366-1180 www.conwedfibers.com
EcoFibre Plus Tackifier	Profile Products LLC Buffalo Grove, IL Phone: 1-800-366-1180 www.profile-eco.com
Terra-Mulch Wood with Tacking Agent 3	Profile Products LLC Buffalo Grove, IL Phone: 1-800-726-6371 www.terra-mulch.com
Excel Fiber Mulch II with Tackifier	American Excelsior Co. Arlington, TX Phone: 1-800-777-7645 www.curlex.com

PART 3 EXECUTION

3.01 PREPARATION FOR PLANTING

A. Before seeding or fertilizing, remove stones, sticks, roots, rubbish, and other extraneous matter over one (1) inch in any dimensions.

B. If weeds are a problem, apply a glyphosate herbicide (Roundup®) and allow weeds to burn down for at least 7 days. The soil shall be tilled to a depth of at least 4 inches by discing,

harrowing, by the use of roto-tillage machinery or other approved operation until a finely pulverized seed bed is obtained.

C. Grade areas to smooth, even surface with loose, uniformly fine texture. Firm up the seedbed by dragging and/or roll packing. When walked on, you should not sink more than 1".

3.02 FERTILIZING

A. Apply fertilizer at 150 lbs per acre or per manufacturer's recommendation.

B. Fertilizer shall be incorporated into the soil to a depth of at least two (2) inches and may be incorporated as a part of the tillage operation.

3.03 PLANTING AND SEEDING

A. Apply grass seed mixture at a rate of application.

B. Seeding shall be done with a press drill equipped with a seed box with positive feed seeding mechanism with agitator, individually mounted double disk furrow openers and packer wheels spaced approximately three (3) inches apart (or two passes with equipment having a six (6) inch spacing), and a separate box for small seeded grasses ("Brillion") mechanical seeder or equal). Each drill shall be equipped with an accurate meter to measure the area covered by the drill.

C. Seed shall be sown ½ in one direction and ½ at right angles to the direction of the first sowing. The direction of the final sowing shall be at right angles to the direction of the slope or parallel to the direction of the contour lines. Seed shall be sown at a final compacted depth of approximately three-fourths (3/4) to one (1) inch.

D. Seeding shall be completed during the following times:

Spring:	April - June
Fall:	August – Early September
Dormant:	November – Freeze Up

3.04 MULCHING

A. Mulching will be required on all seeded areas or as directed by the Engineer in the field.

B. Fiber Mulch shall be applied at a rate of 2,000 pounds per acre unless otherwise specified by the Engineer. Excessive thickness of mulch, which will smother grass seedlings, shall be avoided. Mulch shall be placed on a given area as soon as possible, or within 48 hours after seeding.

3.05 TEMPORARY EROSION CONTROL

A. Contractor shall be required to place temporary erosion control as per requirements of Section 01 57 00.

B. When permanent seeding cannot be completed within 14 days of final grading, or between the dates allowed for seeding, temporary seeding will be required to be installed in disturbed areas. Temporary seeding will be completed utilizing the Temporary Seed Mixture specified.

C. If seeding cannot be completed prior to November 1, the disturbed areas will be required to be mulched at the rate specified to stabilize the areas until seeding can be completed as specified.

3.06 MAINTENANCE AND RESEEDING

A. Maintenance of seeding will begin immediately after each area is planted and will continue until completion of the one (1) year warranty period required under the Contract. Maintenance shall consist of the repair of all eroded areas, the repair or replacement and restapling of loose or undermined erosion control fabric/blanket, and reseeding of eroded areas.

B. Any area that fails to show a "catch" or uniform stand, for any reason whatsoever shall be reseeded with the original mixture one additional time at no additional cost to the Owner.

C. The Contractor shall properly mow, control weeds, and otherwise maintain all areas to be seeded until the areas are properly seeded, fertilized, and mulched. Once the area is properly seeded, fertilized, and mulched to the acceptance of the Engineer, the Contractor will not be required to provide additional maintenance except as identified in A and B above.

* * * END OF SECTION * * *

DIVISION 33 – UTILITIES

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SECTION 33 01 00 - EXISTING UNDERGROUND UTILITIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.

1.02 SCOPE

A. This Section describes, but is not limited to, the relationship of the Project to existing underground utilities and the Work associated with the location, adjustment, and repair of underground utilities.

B. The information and data relative to existing underground utilities are provided to assist the Contractor with the preparation of his bid. This information should not be used by the Contractor for reference during construction of the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Existing underground utilities, as shown on the drawings, are located in accordance with available data, but locations may vary and cannot be guaranteed. The exact locations shall be determined by each Contractor as the Work proceeds. Excavation work shall be done carefully so as to avoid damaging the existing utilities and Work.

B. Each Contractor shall provide for protection, temporary removal and replacement or relocation of obstructions as required for the performance of this Work required in these contract documents.

C. Other obstructions not shown on the plans and requiring relocation shall be exposed by the Contractor without injury; or if injured, shall be repaired by Contractor at his expense. Removal of such obstruction or its relocation shall be made by the Contractor according to the provisions of the General Conditions.

3.02 UTILITY CONTACT

A. Prior to Work in a specific area affecting underground utilities, the following individuals shall be notified as appropriate:

B. All above utilities, excepting water, may be located utilizing the South Dakota One Call Notification Center:

(Locate Phone Number) 1-800-781-7474

(Admin. Phone Number) 1-800-422-1242

C. The failure of any utility to be present for any reason, at the Pre-Construction Conference, if

held, shall not relieve the Contractor of any responsibility described herein.

3.03 UTILITY REPAIR:

A. When an underground utility is exposed or damaged, the Contractor shall comply with the repair requirements of the affected utility.

B. When an underground utility is exposed, the Contractor shall compact the backfill beneath the exposed utility before completion of the backfill operation.

3.04 SANITARY/STORM SEWER AND WATER MAIN SEPARATION:

A. Horizontal Separation - Sewers shall be laid at least 10 feet (3.0 m) horizontally from any existing or proposed watermain. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot (3.0 m) separation, the Department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a watermain, provided that the watermain is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the watermain is at least 18 inches above the top of the sewer.

B. If it is impossible to obtain proper horizontal separation as described above, both the watermain and sewer shall be constructed of slip-on or mechanical joint pipe complying with public water supply design standards of the Department and be pressure tested in accordance with AWWA standards to assure water tightness before backfilling.

C. Vertical Separation

1. Sewers Crossing Under Watermains - The sewer shall be laid to provide a minimum of 18 inches from the top of the sewer to the bottom of the watermain. The crossing shall be arranged so the sewer joints will be equidistant and as far as possible from the watermain.

2. Sewers Crossing Over Watermains - Either the watermain or the sewermain must be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.

3. Special Conditions - When it is impossible to obtain the proper horizontal and vertical separation as stipulated above, one of the following methods shall be specified:

4. Water Pipe - The sewer shall be designed and constructed equal to water pipe and shall be pressure tested in accordance with AWWA standards prior to backfilling to assure water tightness; or;

5. Carrier Pipe - Either the watermain or the sewermain may be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.

D. Storm Sewer Requirements:

1. A reinforced concrete pipe (RCP) storm sewer may cross below a watermain with a separation of less than 18 inches or at any height above a watermain provided the joints on the RCP within 10 feet of either side of the watermain are assembled with:

2. Preformed butyl rubber sealant meeting federal specification #SS-S-210Aand AASHTO M 198, and each of these joints are encased with a minimum 2-foot wide by 6-inch thick concrete collar centered over the joint and reinforced with the equivalent steel area as that in the RCP. Encasement of the watermain will not be required when the RCP joints are collared within the 20-foot section.
3. An O-ring that conforms to ASTM C 443 specifications. O-rings are manufactured for concrete pipe with diameters up to 18 inches.
4. A strip of impermeable material held in place with stainless steel bands and tested to 5 psi prior to the storm sewer being put into use.

E. There shall be at least a 10-foot horizontal separation between watermains and sanitary sewer forcemains. There shall be an 18-inch vertical separation at crossings as required in paragraphs B and C.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate measurement made.

4.02 BASIS OF PAYMENT

A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate and payment to be made.

* * * END OF SECTION * * *

SECTION 33 05 19 - PRESSURE PIPING TIED JOINT RESTRAINT SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this section.

B. Related requirements specified elsewhere:

1. Watermain Piping and Fittings - Section 33 11 00
2. Sanitary Sewer Piping and Fittings – Section 33 31 00
3. Standard Drawing - No. 33 05 19-1

1.02 DESCRIPTION OF WORK

A. This Section covers the furnishing and installation of thrust blocks, anchors, and restraining devices where necessary.

1.03 SUBMITTALS

A. The Contractor shall submit for review copies of shop drawings for restraining devices as specified herein in accordance with the requirements of Section 01 33 23 and the requirements as hereinafter specified.

1.04 LOCATION

A. Thrust blocks shall be furnished at locations including, but not limited to, the following:

1. Tees
2. Bends
3. Valves
4. Wyes
5. Caps

B. Restraining devices shall be installed at locations including, but not limited to, the following:

1. Tees
2. Bends
3. Wyes
4. Valves
5. Fire Hydrants
6. Caps

PART 2 PRODUCTS

2.01 CONCRETE

A. All concrete shall be minimum 3,000 psi compressive strength. Precast concrete blocks shall be solid construction and conform to ASTM C 55.

2.02 RESTRAINING DEVICES

A. Restraint devices for use on ductile iron and C-900 PVC "pushon" joints shall be constructed of high strength ductile iron, ASTM A536, Grade 65-45-12 and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be 304 (A2) or 316 (A4) Stainless Steel. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Pre-Approved restraining devices are: Uni-Flange Block Buster Series 1390-C; Star Pipe Products Allgrip series 3600 and Pipe Restrainers Series 1200S; EBAA Iron, Inc. Mega-Lug Series 1700; or Engineer approved equal.

B. Restraint devices for use on mechanical joint to C-900 PVC, shall be constructed of high strength ductile iron, conforming to the requirements of ASTM A536, Grade 65-45-12, and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be 304 (A2) or 316 (A4) Stainless Steel. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Pre-Approved restraining devices are: Uni-Flange Series 1500; Star Pipe Products, Allgrip Series 3600; Romac Industries, Inc GripRing; Romac Industries, Inc RomaGrip; EBAA Iron, Inc. Mega-Lug Series 2000; or Engineer approved equal.

C. Restraint devices for use on mechanical joint ductile iron, shall be constructed of high strength ductile iron, conforming to the requirements of ASTM A536, Grade 65-45-12, and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be 304 (A2) or 316 (A4) Stainless Steel. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Pre-Approved restraining devices are: Uni-Flange Series 1300-C; Star Pipe Products, Allgrip Series 3600; Romac Industries, Inc. GripRing; EBAA Iron, Inc. Mega-Lug Series 1100; or Engineer approved equal.

PART 3 INSTALLATION

3.01 THRUST BLOCK INSTALLATION

A. The thrust blocks shall be constructed and/or placed so that the bearing surface is in direct line with the major force created by the pipe or fitting.

B. The cast-in-place thrust blocks shall be constructed by pouring concrete between the fitting and the undisturbed trench shall be the bearing surface. Precast concrete blocks shall be installed by placing blocks between fitting and undisturbed wall. The precast concrete blocks shall be placed to provide a minimum of four (4) inches of concrete between fitting and

undisturbed trench wall.

C. The cast-in-place concrete shall not be allowed to cover the bolts of any fitting.

D. Thrust restraints shall be completed in accordance with ANSI/AWWA C605/5.7 for PVC Pipe, ANSI/AWWA C600/4.28 for Ductile Iron Pipe, ANSI/AWWA 907, AWWA Manual M23, and as recommended by the Manufacturer.

3.02 RESTRAINING DEVICE INSTALLATION

A. The Contractor shall install restraining devices in accordance with the manufacturer's recommendations.

PART 4 MEASUREMENT AND PAYMENT

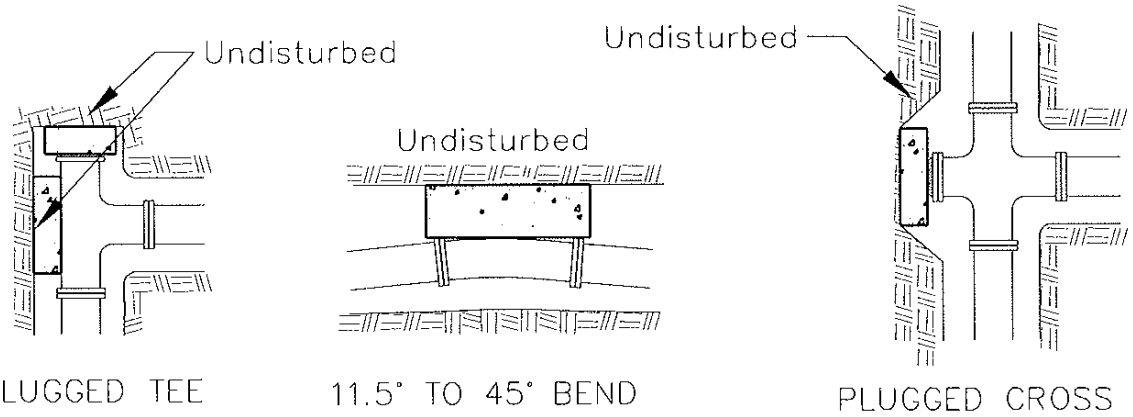
4.01 METHOD OF MEASUREMENT

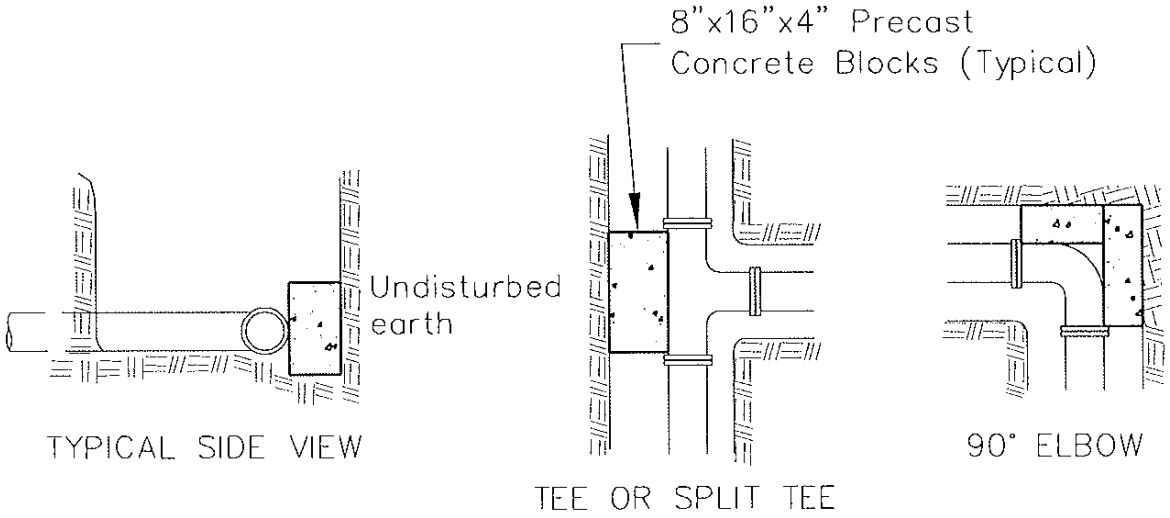
A. Thrust blocks and restraining devices are considered incidental to the fitting, valve, or appurtenance with no separate measurement and payment to be made.

4.02 BASIS OF PAYMENT

A. No separate payment will be made for thrust blocks and restraining devices.

* * * END OF SECTION * * *





Note: The Contractor shall be required to furnish and install both the mechanical anchors and precast concrete blocks in those locations as shown.

THRUST BLOCK LOCATIONS

FOR

PRESSURE PIPING INSTALLATIONS

SCALE: NONE

Helms ASSOCIATES

CIVIL ENGINEERS & LAND SURVEYORS

* * * END OF SECTION * * *

SECTION 33 12 13 – WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and provisions of Division 1. General Requirements, apply to work specified in this section.

1.02 DESCRIPTION OF WORK

A. The work covered under this section of the specifications shall include the furnishing of all material, labor, tools and equipment to construct, complete in place, all saddle connections.

1.03 DESCRIPTION OF WORK

A. The work covered under this section of the specifications shall include the furnishing of all material, labor, tools, and equipment to construct, complete in place, all service connections including saddles, corporations, service pipe, and curb stops.

1.04 SUBMITTALS

A. The Contractor shall submit for review copies of shop drawings for materials specified herein in accordance with the requirements of Section 01 33 23 and the requirements as hereinafter specified.

B. Certifications for all fasteners shall be provided for valves, fittings, and all other appurtenances provided under this specification.

C. Certification shall be provided that all pipes, plumbing fittings, and fixtures are “Lead Free” in accordance with the January 4, 2011 modification to Section 1417 of the Safe Drinking Water Act.

PART 2 PRODUCTS

2.01 SERVICE PIPE

A. Service Pipe, when shown on the plans or on the bid form, shall be type K soft copper tubing meeting the requirements of ASTM B88.

B. All fittings shall have compression style couplers and the fittings shall be brass. All PE tubing will utilize stainless steel inserts at all fittings.

2.02 SADDLES

A. The body shall be made of high strength ductile iron per ASTM A536.

B. The clamping band shall be a double wide band with 5/8" UNC threaded bolts of 18-8 type 304 stainless steel with stainless steel spring tension washers under the nuts.

C. The gasket shall be EPDM rubber per ASTM-D2000.

D. The finish on saddle body shall be fusion bonded epoxy coating approximately 12 mils thick.

E. Pre-Approved saddles are as manufactured by: Ford Meter Box Co., style FC202; JCM Industries, Inc., Model No. 406; Mueller Company, DR 2; A.Y. McDonald; Romac

Industries, Inc., Style 101NS & 202NS;or Engineer approved equal.

2.03 CORPORATION STOPS

A. Corporation stops shall be designed and manufactured in accordance with AWWA C800 and shall have standard AWWA Ball Joint end connection. Corporation shall be Type F1000 pack joint, FB1000 pack joint, or equal manufactured by the Ford Meter Box Co., latest design for the intended use, or approved equivalent. Pre-Approved corporations are as manufactured by: Ford Meter Box Co.; A.Y. McDonald; or Engineer approved equal with latest design for the intended use.

B. Corp Stop compression joints will be provided with an optional tracer wire hole that has a set screw for a positive connection.

2.04 CURB STOPS WITH BOXES

A. Curb stops shall be of the size indicated on the plans. Inlet and outlet shall be pack joint. Curb Stop shall be provided with 2" base thread for curb box.

B. Curb box shall be Minneapolis Base with 1 ½" or 2" base thread. Box riser shall be minimum 1 ¼" in diameter. Box shall be fully adjustable between 6' and 7'. Lid shall have brass pentagon head plug. Contractor shall verify top nut dimensions with owner to insure compatibility with existing system. Contractor shall provide two curb box keys and shut-off wrenches to the Owner.

C. Pre-Approved curb stops are as manufactured by: Ford Meter Box Company; Mueller Company; A.Y. McDonald; or Engineer approved equal.

D. Curb Box lids will also be provided with a tracer wire screw that is tapped into the bottom of the lid for securing a quick connect eyelet terminal. Once tightened, the threaded end of the screw becomes accessible for attaching an alligator clip at the top of the lid.

PART 3 INSTALLATION

3.01 COMPRESSION COUPLERS

A. On copper tubing, use a rounding tool, if necessary. Surface should be clean and free of nicks.

B. Stab tube or pipe through the nut and into the socket of the valve or fitting until it bottoms out (some fittings may or may not have a stop).

C. If the nut or socket appears too large or small, a check should be made to be sure you are using the correct fitting and pipe/tube.

D. Tighten the Mac-Pak nut onto the valve or fitting to the Manufacturer's recommendations.

E. Lock the tube or pipe into the nut by securely tightening the split clamp side screw (use a box end or socket wrench, not a screwdriver). For soft copper, the torques to which the clamp side screw should be tightened to manufacture's recommendations.

F. Pressure test for leaks before backfilling.

G. Use only on cold water services.

3.02 CORPORATION STOPS

A. Protect threads Nicks or distorted threads, especially on tapered threads, can cause leaks.

B. Use a good thread sealant where threads are intended to provide a leak-proof connection. Do not over tighten.

C. Do not use Vaseline, plumber's grease, or any other petroleum product on seals or o-rings.

D. Use only a smooth jawed adjustable wrench on the flats provided nearest the thread being made up. Serrated pipe wrenches apply a loose, improper fit that can distort the body and cause a leak, especially on valves.

E. Plug style corp valves should be installed so that the wrenching flats of a tightened valve are positioned top and bottom.

F. Avoid dropping or the use of a hammer on any plug or key type valve. Impacts, causing dents or distortion, can cause leaks by unseating the plug portion of the valve.

G. Pressure test for leaks before backfilling.

H. Backfill carefully to avoid damage to the service line and connections. Loop service piping on corporation connections to minimize strain on the body and connections.

3.03 SADDLES

A. Make sure you have proper type and size saddle for pipe.

B. Clean pipe surface thoroughly.

C. Lubricate face of gasket.

D. Mount saddle on pipe with outlet facing desired direction.

E. Evenly tighten bolts and nuts to the torque specified below. Saddles without hinges require opposite sides of the saddle to be tightened evenly, keeping an even distance and torque on each side. Brass bottom saddles are not designed to bottom out when tightening. Over-tightening can cause breakage.

F. After the corporation stop has been installed, recheck saddle torque and tighten if necessary.

* * * END OF SECTION * * *

SECTION 33 12 16 – WATER UTILITY DISTRIBUTION VALVES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.

B. Related requirements specified elsewhere:

1. Watermain Piping and Fittings – Section 33 11 00
2. Sanitary Sewer Piping and Fittings - Section 33 31 00

1.02 DESCRIPTION OF WORK

A. This section covers the furnishing and installation of valves and appurtenances as specified herein and as shown on the plans.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All valves and related appurtenances shall be shipped in accordance to the requirements of AWWA C509 or C515. Valve ends shall be sealed to prevent the entry of foreign matter into the valve body. The boxes and crates in which valves are shipped shall completely enclose and protect the valve and accessories from foreign matter.

B. Valves and accessories shall be stored in a manner so as to be protected from weather, moisture, and other possible damage. Materials shall not be stored directly on the ground.

C. All material shall be handled in a manner that will prevent damage to the interior and exterior surfaces.

1.04 SUBMITTALS

A. The Contractor shall submit for review copies of shop drawings for materials specified herein in accordance with the requirements of Section 01 33 23 and the requirements as hereinafter specified.

B. Certification of performance, leakage, and hydrostatic tests as described in Section 5 of AWWA C-509/515 (Resilient Seated Gate Valves) shall be furnished when requested by the Engineer.

C. Certifications for all fasteners shall be provided for valves, fittings, and all other appurtenances provided under this specification.

PART 2 PRODUCTS

2.01 GATE VALVES

A. Gate valves shall be resilient wedge type manufactured to meet all applicable requirements of AWWA Standard for Resilient Seated Gate Valve C509 or C515.

B. All valves shall have non-rising stems, opening by turning left and provided with standard 2" square nut operator with arrow cast in metal to indicate direction of opening.

C. Cast iron wedge shall have sealing surfaces of the wedge permanently bonded with resilient material to meet ASTM tests for rubber to metal bond ASTM D429. Each valve shall have a smooth unobstructed waterway free from any sediment pockets. Stuffing boxes shall be O Ring seal type with 2 rings located in stem above thrust collar. Low friction torque reduction thrust bearings shall be located both above and below the stem collar.

D. Body and cover bolts and nuts shall be Grade 304 (A2) or 316 (A4) stainless steel. Anti-Seize shall be applied to all threads prior to installation.

E. Exterior and interior coatings in accordance with ANSI/AWWA C550 for potable water.

F. Non-rising stems shall be in full compliance with AWWA specification with cast integral stem collar and furnished of bronze conforming to ASTM B584 Alloy A. Stem nuts shall be independent of wedge and shall be made of solid bronze conforming to ASTM B 62.

G. Valves shall have hydrostatic shell test of 400 psi and shut-off test of 200 psi. At the 200-psi shut-off test, valve must be bubble-tight with a zero (0) leakage allowance.

H. Resilient wedge gate valves shall be the product of a manufacturer having a minimum of five (5) years experience in the manufacture of water works and distribution valves.

I. Pre-Approved resilient wedge gate valves are as manufactured by: American Darling Valve Co., Birmingham, Alabama; Mueller Company, Decatur, Illinois; Clow Valve Division, Oskaloosa, Iowa; American AVK, Minden, NV; or Engineer approved equal.

2.02 VALVE BOXES

A. Valve boxes shall be cast iron, 5-1/4" inside diameter, adjustable valve boxes of the screw type with sufficient length for the pipe bury as shown. Where the valve box is shown or required on control manholes, the length shall be sufficient to penetrate the valve marker and the Type II reinforced manhole cover. The cast iron cover of the valve box shall have an arrow indicating the direction of opening.

B. Covers for water piping shall have the word "WATER" cast on the top.

C. Pre-Approved valve boxes and covers are as manufactured by: Tyler Pipe Utilities Division, Tyler, Texas; Mueller Co., Decatur, Illinois; Clow Corporation, Oak Brook, Illinois; or Engineer approved equal.

D. Each valve box shall be furnished with valve box centering adaptor compatible with the valve boxes furnished.

E. The Contractor shall furnish one T-handled valve wrench to the owner that is compatible with the installed valves.

2.03 FASTENERS

A. All fasteners in buried locations shall be Grade 304 (A2) or 316 (A4) stainless steel. Anti-Seize shall be applied to all threads prior to installation.

2.04 POLYETHYLENE WRAP

A. All ductile fittings shall be wrapped with polyethylene plastic film having a minimum thickness of 0.008 inches or with a cross woven polyethylene plastic film having a minimum thickness of 0.004 inches.

PART 3 EXECUTION

3.01 VALVE INSTALLATION

A. All valves shall be installed in locations as shown on the plans or as directed by the Owner's Resident Project representative.

B. The valve and joints shall be installed in accordance with the manufacturer's recommendations.

C. All pipe bevels shall be removed prior to installation of any valve or ductile iron fitting.

3.02 VALVE BOX INSTALLATION

A. All foreign material and debris shall be removed from the top of the valve operator prior to setting the valve box.

B. Valve box centering device shall be installed to center valve box on valve.

C. Valve boxes shall be centered and plumb over the operating nut of the valve and shall be set so that no shock or stress will be transmitted to the valve.

D. Tops of the valve boxes shall be set flush with the valve identification collar or manhole cover unless otherwise directed.

* * * END OF SECTION * * *

SECTION 33 12 19 – WATER UTILITY DISTRIBUTION FIRE HYDRANTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions shall apply to the work covered in this section.

B. Related work specified elsewhere.

1. Trenching, Backfilling and Compacting - Section 31 23 33
2. Pressure Piping Tied Joint Restraint System - Section 33 05 19
3. Disinfection of Water Utility Distribution- Section 33 13 00
4. Testing of Water Utility Distribution - Section 33 13 01

1.02 DESCRIPTION OF WORK

A. The work covered under this section of the specifications shall include the furnishing of all material, labor, tools and equipment necessary to furnish and install, complete in place, all piping, fittings, blocking and hydrants of the size and type as shown on the plans.

1.03 SUBMITTALS

A. The contractor shall submit for review copies of shop drawings for materials specified in accordance with the requirements of Section 01 33 23 and the requirements as specified herein.

B. Certificates from the manufacturer that the materials meet or exceed specified requirements, including fasteners.

C. The manufacturer's installation recommendations, including blocking, joint type, lubricants, etc. to be used.

D. Certification shall be provided that all pipes, plumbing fittings, and fixtures are “Lead Free” in accordance with the January 4, 2011 modification to Section 1417 of the Safe Drinking Water Act.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All material shall be packed, loaded, transported, handled and stored in such a manner so as to prevent damage to the materials.

B. Materials stored on the site shall be stored in accordance with manufacturer's recommendation and shall be protected from damage and theft. Materials shall not be stored directly on the ground.

C. The inside of all materials are to be kept dry and clean of all debris and dirt.

PART 2 PRODUCTS

2.01 FIRE HYDRANT

A. The fire hydrants shall be model WB-67, as manufactured by the Waterous Company, or Engineer approved equal and shall conform to AWWA Standard C-502, as well as the following specifications:

1. The bury depth to top of pipe shall be 7-0 feet. The inlet shall be a 6-inch Mechanical Joint pipe connection. The nominal diameter of the main valve opening shall be 5 1/4-inches. Hydrants shall be provided with one (1) 4-inch pumper/nozzle and two (2) 2-inch hose nozzles all with National standard thread. The operating nut and the nozzle caps shall be 1 inch square. The direction of opening the hydrant shall be counter-clockwise (open left). In addition to the coatings specified in Section 6 of AWWA Standard C-502; the outside of the hydrant shall be **Red** in color.
2. The hydrant bonnet must be designed so that the thrust collar shall have either or both, a Teflon impregnated "anti-friction" washer and/or a lubrication system that automatically lubricates the thrust collar during each hydrant operation.
3. Lubrication for hydrant shall be non-toxic oil or grease, due to cold weather characteristics of grease. Hydrant oil reservoir shall have double O-ring seal between stem and reservoir to prohibit water from entering the reservoir.
4. The hydrant shall be a "traffic" model designed to separate at ground level upon impact without water flowing and with minimal damage confined to breakable stem coupling and breakable barrel flange. Distance from breakable flange to the center of the nozzle shall be 23-inch minimum. Breakable or frangible bolts will not be allowed. Breakable stem coupling shall be cast iron.
5. The hydrant shall have a positive drain valve as an integral part of the main valve assembly. The main valve shall be a compression type closing with the water pressure. All bronze components of the hydrant shall be "waterworks" bronze, ASTM-B-62. The main valve seat ring shall thread into bronze threads for ease of removal for repairs of main valve.
6. The internal ferrous metal surfaces of the hydrant shoe shall be protected with a long-term epoxy coating that is fully compliant with AWWA C550. **All body bolts buried below grade shall be grade 304 (A2) or 316 (A4) stainless steel.**
7. All fasteners shall be grade 304 (A2) or 316 (A4) stainless steel. Anti-Seize shall be applied to all threads prior to installation.
8. Alternate fluid type “Tyton” joint connection on hydrant shoe shall conform to AWWA C907 PVC specifications for use with 6-inch C-900 Class 15.

B. Break-off repair kit, including seals, shall be provided based on the following schedule:

1. 1 to 15 hydrants furnished, one (1) kit

2.02 FASTENERS

A. All fasteners in buried locations shall be Grade 304 (A2) or 316 (A4) stainless steel. Anti-Seize shall be applied to all threads prior to installation.

PART 3 EXECUTION

3.01 EXCAVATION, FILLING, AND COMPACTION

A. Excavation of trench for fire hydrant shall be so that blocking below and behind hydrant may be placed against undisturbed earth.

B. The backfill shall be placed in lifts not exceeding 1-foot loose thickness. Each lift shall be mechanically tamped to 95% of maximum density as determined by the standard proctor method.

3.02 THRUST REACTION

A. The Contractor shall install restraining rings on all hydrant leads. Typical thrust blocking will still be required.

B. Concrete blocking shall be placed beneath and behind the fire hydrant and at all points subject to thrust reaction. Blocking shall be a least 8" x 16" x 6" and shall be placed against undisturbed earth.

C. Concrete reaction blocking shall be placed so that all pipe and fitting joints are accessible for repair.

* * END OF SECTION * * *

SECTION 33 13 00 - DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions shall apply to the work covered in this section.

1.02 DESCRIPTION OF WORK

A. This section covers flushing of new and existing water lines, and disinfection of the installed piping.

B. The Contractor shall furnish all water required for flushing and disinfection work as specified in the temporary facilities section.

C. The Contractor shall provide, at his own expense, all means required for draining and disposing of water used in flushing and disinfection. This shall include, but not be limited to, additional drain valves, temporary piping and pumping equipment. Wastewater shall be stored and/or treated, if required, so as to cause the water quality to meet the requirements of the S. D. Department of Environment & Natural Resources for discharge. Contact the South Dakota Department of Environment & Natural Resources at 1-800-737-8676 for more information.

1.03 SUBMITTALS

A. Copies of all bacteriological test reports shall be furnished to the Engineer and Resident Project Representative.

PART 2 PRODUCTS

2.01 CHLORINE

A. Liquid chlorine shall conform to AWWA Specification B-301.

B. Hypochlorites shall conform to AWWA Specification B-300.

PART 3 EXECUTION

3.01 CLEANING AND FLUSHING

A. All lines shall be thoroughly flushed before acceptance until all traces of construction materials, soil or other foreign matter have been removed.

B. The Contractor shall take all necessary measures to protect adjacent facilities and property. Damages caused by flushing water or water carried material shall be the responsibility of the Contractor.

C. All flushing shall be completed prior to the initiation of the disinfection process described herein.

D. The chlorinated water used for disinfection/pressure testing shall not be discharged to a

stream, river, or other waterway where danger to aquatic life may occur. Dechlorination may be necessary prior to discharge. Contact the SD-DANR Surface Water Quality Program at 1-800-737-8676 for more information.

3.02 PIPELINE DISINFECTION

A. Each unit of completed supply line and distribution system shall be sterilized with chlorine before acceptance.

B. The amount of chlorine applied shall be such as to provide a dosage of not less than 50 parts per million. The chlorinating material shall be introduced to the water lines and distribution system in an approved manner. If possible to do so, the lines shall be thoroughly flushed before introduction of the chlorinating material.

C. After a contact period of not less than 24 hours, the system shall be flushed with clean water until the residual chlorine content is not greater than 1.0 parts per million. All valves in the lines being sterilized shall be opened and closed several times during the contact period.

D. Prior to final flushing, the treated water shall contain at least 25-ppm chlorine as per AWWA Specification C651.

E. After the disinfection and flushing process, two (2) consecutive samples of water from the end of the disinfected water line must be collected at least 24 hours apart and submitted to the State Health Laboratory in Pierre or another approved laboratory. The sample shall be found free of bacteria before the system is placed into service.

F. Should the sample be returned positive, the disinfection process shall be repeated until negative samples are obtained.

* * * END OF SECTION * * *

SECTION 33 13 01 - TESTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this section.

1.02 DESCRIPTION OF WORK

A. All piping and related appurtenances shall be subjected to alignment and pressure and/or leakage tests as specified herein and as directed by the Engineer.

B. The required pressure and leakage tests shall be made by the Contractor and witnessed by the Engineer. All tests shall be completed after all pipe laying has been completed. All concrete reaction blocks and bracing or restraining facilities shall be in place at least 7 days before the initial pressure testing of the lines, except where tension joints are used at bends.

C. The Contractor shall perform the necessary work to fill the pipeline with test water as specified. The Contractor shall furnish all water, pumping equipment, water meter, pressure gage, and other equipment, materials, and facilities required for the tests.

1.03 SUBMITTALS

A. Prior to filling, flushing and testing the system, the proposed procedures shall be submitted for review by the Engineer.

B. Pressure test forms completed in the field shall be submitted to the Engineer and Owner.

PART 2 PRODUCTS - None

PART 3 EXECUTION

3.01 TEST SECTIONS

A. The pressure and leakage tests shall be applied to all sections of the line with a section being the shortest practical length between shut-off valves.

B. The Contractor shall be solely responsible for any and all damage to the pipeline, and to public and private property, which may result from defective material or workmanship.

C. The chlorinated water used for disinfection/pressure testing shall not be discharged to a stream, river, or other waterway where danger to aquatic life may occur. Dechlorination may be necessary prior to discharge. Contact the SD-DANR Surface Water Quality Program at (605) 773-3351 for more information.

3.02 FILLING AND VENTING OF WATERMAINS

A. The section of line to be tested shall be slowly filled with water and all air expelled from the pipe. Care shall be taken that all air valves are installed and open in the section being filled and that the rate of filling does not exceed the venting capacity of the air valves.

3.03 TEST EQUIPMENT AND FACILITIES

A. Test pressures shall be applied by means of a force pump of such design and capacity that the required pressure can be applied and maintained without interruption for the duration of each test.

B. The water meter and the pressure gage shall be accurately calibrated and shall be subject to the approval of the Engineer.

3.04 WATERMAIN PRESSURE TEST

A. Test pressures shall be applied to each section of pipeline with all connections, valves and fittings along the length of the test section in place.

B. The pressure test shall be initiated by bringing the hydrostatic pressure in the section being tested to a minimum of 90 psi, as measured at the highest point of the section being tested.

C. After the section of the line to be tested has been filled with water and brought to the specified level, the test pressure shall be maintained for a period of not less than one hour, or for whatever longer period as may be necessary for the Engineer to complete the inspection of the line under test, or for the Contractor to locate any and all defective joints and pipeline materials.

D. If repairs are needed, such repairs shall be made, the line refilled and the test pressure applied as before; this operation shall be repeated until the line and all parts thereof withstand the test pressure in a satisfactory manner.

3.05 WATERMAIN LEAKAGE TEST

A. All hydrostatic testing shall be completed in accordance with ANSI/AWWA C600/Sec. 5.2 for ductile iron pipe and ANSI/AWWA C605/Sec. 7.3 for PVC pipe.

B. After the specified pressure test has been completed, the line being tested shall be subjected to a leakage test under the same hydrostatic pressure specified. The pressure shall be maintained constant (within a maximum variation, plus or minus, of 5%) during the entire time that line leakage measurements are being made so that the allowable leakage rate may be determined accurately from the leakage rate formula.

C. Leakage testing shall not be started until a constant test pressure has been established. After the test pressure has been established and stabilized, the line leakage shall be measured by means of a water meter installed on the line side of the force pump.

D. Line leakage is defined as the total amount of water introduced into the line as measured by the meter during the leakage test. The pipeline or tested section thereof will not be accepted if and while it has a leakage rate in excess of the following rate:

1. Leakage rate for ductile iron buried pipelines shall be as determined by the following formula:

   $L=S*D*\sqrt{P} \div 148{,}000$

   in which: Q = Maximum permissible leakage rate, in gallons per hour, throughout the entire length of line being tested.

   S = Length of line under test in feet.

D = Nominal diameter (in inches) of the pipe in the line.

P = The average test pressure, in psig, in the tested portion of the line.

2. Leakage rate for PVC buried pipelines shall be as determined by the following formula:

   $Q=L*D*\sqrt{P} \div 148,000$

   in which: Q = Maximum permissible leakage rate, in gallons per hour, throughout the entire length of line being tested.

   L = Length of line under test in feet.

   D = Nominal diameter (in inches) of the pipe in the line.

   P = The average test pressure, in psig, in the tested portion of the line.

E. Where the leakage rate is in excess of the permissible maximum, the Contractor shall be responsible for the location and the repair of all leaks to the extent required to reduce the total leakage to an acceptable amount.

F. All joints in piping in non-buried locations shall be watertight and free from visible leaks during the prescribed tests.

G. Each and every leak which may be discovered at any time prior to the expiration of one year from and after the date of final acceptance of the work by the Owner shall be located and repaired by and at the expense of the Contractor regardless of any amount that the total line leakage rate during the specified leakage test may be below the specified maximum rate.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

A. Pipeline testing will not be measured for direct payment and will be considered subsidiary work pertaining to the contract.

4.02 BASIS OF PAYMENT

A. No direct compensation will be made for this work. Payment will be included in the contract bid prices as shown on the Bid Form.

* * * END OF SECTION * * *

SECTION 33 31 00 – SANITARY SEWER PIPING AND FITTINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this section.

B. Related Work Specified Elsewhere:

1. Trenching, Backfilling and Compacting - Section 31 23 33
2. Pressure Piping Tied Joint Restraint System - Section 33 05 19
3. Standard Drawing: 33 31 00-1

1.02 DESCRIPTION OF WORK

A. The work covered under these specifications shall include the furnishing of all labor, material, tools, and equipment necessary to furnish and install, complete in place, all piping and fittings as shown on the drawings and as specified herein.

1.03 SUBMITTALS

A. The Contractor shall submit for review 5 copies of shop drawings for materials specified herein as hereinafter specified.

B. Certificates from the manufacturer that the materials meet or exceed specified requirements.

C. The manufacturer's installation recommendations, including types and amounts of gasket lubricant, where applicable, to be used.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials shall be packed, loaded, transported, unloaded, and handled in such a manner so as to prevent damage to the materials.

B. All material shall be loaded and unloaded by lifting with slings or hoists or skidding so as to avoid shock or damage. Dropping or rolling will not be permitted. The use of end hooks to install or move piping will not be allowed.

C. All materials shall be stored on the site in accordance with the manufacturer's recommendations. Do not store materials directly on the ground.

D. All materials shall be kept clean and dry. The insides of all piping and fittings shall be kept free of dirt and debris.

PART 2 PRODUCTS

2.01 GRAVITY PVC PIPE

A. Polyvinyl Chloride (PVC) gravity pipe shall be Type I, Grade I, conforming to the requirements of ASTM Specification D 3034 for Rigid Poly (Vinyl Chloride) Sewer pipe. The pipe shall following the minimum wall thickness for SDR 35 piping.

B. Solvent Cement for PVC pipe joints shall conform to ASTM Specification ASTM D 2564 and shall be applied in conformance with ASTM D 2855. Solvent weld joints will be allowed on PVC cleanout risers only.

C. Gasket type joints shall be made with rubber gaskets conforming to the requirements of ASTM F-477.

D. The pipe shall be capable of withstanding trench loads imposed on it.

2.02 GRAVITY PVC PIPE FITTINGS

A. Repair couplers, tees, wyes, and bends for Polyvinyl Chloride (PVC) gravity pipe fittings shall be of PVC with material and dimensions conforming to the requirements of ASTM Specification D 3034.

B. Gaskets for elastomeric joints shall conform to the requirements of ASTM F-477.

C. Solvent Cement for solvent weld joints shall conform to the requirements of ASTM Specification D 2564 and shall be applied in conformance with ASTM D 2855. Solvent weld joints will be allowed on PVC cleanout risers only.

D. Sewer "Wyes" for service connections shall be in-line sewer wyes. Saddle wyes will not be permitted for use without permission from Project Engineer.

2.03 TRANSITION COUPLINGS (GRAVITY PIPING)

A. GASKET

1. Manufactured to meet the material requirements of:
    a. CSA B602 - mechanical couplings for drain, waste, vent pipe and sewer pipe
    b. ASTM D 5926 - Standard Specification for Poly Vinyl Chloride (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
    c. ASTM C 1173 - Standard Specification for Flexible Transition Couplings for Underground Piping Systems
    d. Hardness, Shore"A", Inst. -+5.....65
    e. Tensile Strength, Min. psi 1000
    f. Elongation at Rupture, Min. %.....250
    g. Tear Strength, Min..... 150 lb/in.
    h. Brittleness Temperature..... -40°F

B. CLAMPS

1. Manufactured to the requirements of CSA B602

2. Clamp Housing- 301 Stainless Steel
3. Clamp Band - 301 Stainless Steel
4. Clamp Screw - 305 Stainless Steel
5. Installation torque 60" lbs

C. SHEAR RING

1. 0.012" Thick, 300 Series Stainless Steel
2. Width manufactured according to coupling width (1.50", 2.13", or 4")
3. Length manufactured according to coupling diameter
4. Clamps spot welded in place

D. COUPLING

1. Manufactured to conform to the performance requirements of:
   a. ASTM C 1173 - standard specification for flexible transition couplings for underground piping systems
   b. CSA B602 - mechanical couplings for drain, waste, vent pipe and sewer pipe
   c. Maximum test pressure: 4.3 PSI (29.6KPA)
   d. Maximum operating temperature: 140° F nonconsistent

E. Pre-Approved transition couplers are Strong Back RC Series Repair Couplings manufactured by Fernco Inc. or Engineer approved equal.

2.04 BEDDING MATERIAL

A. Borrowed granular bedding material shall conform to the gradation indicated below.

Sieve Opening	Bedding Material (Percent Passing)
1"	95-100
No. 200	< 15

B. Borrowed granular bedding material for unstable trench bottom shall conform to the gradation indicated of size 67 Course Aggregate, ASTM C33 which is indicated below.

Sieve Opening	Bedding Material (Percent Passing)
1-1/2"	100
3/4"	90-100
3/8"	20-55
No. 4	0-10
No. 8	0-5

2.05 FASTENERS

A. All fasteners in buried locations shall be Grade 304 (A2) or Grade 316 (A4) stainless steel. Anti-Seize shall be applied to all threads prior to installation.

2.06 LUBRICANT FOR GASKETED PIPE

A. Lubricant shall be an emulsified polymer based product, specifically formulated to be water-soluble without causing turbidity. Lubricant shall not transfer taste and/or odor to new water main installations. Lubricant must not promote bacterial growth and be safe for use on all metal and plastic pipes. Lubricant shall be easily flushed from the line and be non-reactive to chlorinated water. Lubricant should work easily on both wet and dry surfaces.

2.07 POLYETHYLENE WRAP

A. All ductile fittings shall be wrapped with polyethylene plastic film having a minimum thickness of 0.008 inches or with a cross woven polyethylene plastic film having a minimum thickness of 0.004 inches.

2.08 TRACER WIRE (FORCEMAIN)

A. Tracer wire shall be 12-gauge solid copper or high strength stainless steel wire with a 45-mil polyethylene coating. Provide sufficient length to be continuous over each separate run of nonmetallic pipe.

PART 3 EXECUTION

3.01 GENERAL

A. The areas to receive piping shall be examined for defects that may adversely affect the execution and quality of Work. Prior to the start of piping installation, all measurements shall be checked for deviations from allowable tolerances for piping.

3.02 BURIED PIPING INSTALLATION

A. All piping and fittings shall be laid true to line and grade as shown on the plans. Each section of pipe shall be so laid and fitted together that when complete the piping will have a smooth uniform flow line. The inside of all pipe shall be cleaned before installation and kept thoroughly clean during and after the laying. Pipe ends shall be cleaned inside and outside.

B. Apply lubricant liberally to the inside of the pipe bell and spigot. Make sure lubricated surfaces remain free of dirt, gravel, or other debris. Assemble the pipe joint immediately after application of the lubricant.

C. All pipe and fitting shall be examined for defects before being lowered into the trench. The interior and exterior protective coating shall be inspected and field repaired, if required.

D. The pipe shall be handled and installed in accordance with manufacturer's recommendations and the requirements of AWWA C 600 for Ductile Iron pipe, ASTM D 2774 for PVC pressure piping and ASTM D 2321 for PVC gravity sewer piping.

E. When pipe laying is not in progress, including the noon hours, the open ends of pipe shall be closed. No trench water, animals, or foreign material shall be permitted to enter the pipe.

F. Class "C" Bedding shall be used with all piping. The bedding material shall conform to the

requirements of Part 2 above. General requirements for placement are shown on Standard Drawing 333100-1. On all non-rigid piping, care will be taken to provide maximum support in the haunch area of the pipe. This area extends from the bedding material to the center of the pipe. If coarse materials with voids have been used for bedding materials, the same bedding materials will be used for haunching. When a trench box or similar device is used during excavation, the box will be raised sufficiently to recompact the haunch area in the natural trench to 95% maximum dry density as determined by ASTM D 698.

G. After each pipe has been graded, aligned, and placed in final position on the bedding material and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe joining and embedment operations.

H. The pipe shall be laid upon properly placed bedding material so that the barrel of the pipe will have a bearing for its full length. No blocking will be allowed to bring the piping up to grade. Bell holes and depressions for joints shall be excavated after the trench bedding has been graded to provide uniform support for the entire pipe.

I. The Contractor shall provide and maintain all necessary means and devices at all times to remove and dispose of all water entering the trench during the process of pipe laying. The trench shall be kept dry until the pipe laying and jointing are completed. Removal of water shall comply with Section 31 23 33.

J. Thrust blocks or restraining fittings to restrain pressurized piping shall be provided at all abrupt changes in direction, tees, bends, dead ends and hydrants, and shall be in accordance with the pipe manufacturer's recommendations.

K. The Contractor shall place backfill material in lifts not exceeding 1-foot and compact to 95% Standard Proctor Density. Stones equal to or larger than 3-inches in diameter shall not be placed within 2-feet of the pipe.

3.03 EXPOSED PIPING INSTALLATION

A. Each item or system shall be furnished complete and installed as shown on the plans and in accordance with the manufacturer's recommendations, instructions, and directions. All installed equipment and systems shall be properly protected during subsequent construction operation.

B. The Contractor shall inspect all material or equipment as it is received to determine damage and/or missing parts. It shall be his responsibility to repair or replace damaged items in accordance with the manufacturer's instructions.

C. The Contractor shall provide all scaffolding required for the proper installation of this work in conformance with the standards of any local and state safety codes applying to scaffolding.

D. All pipe shall be set such that the vertical and horizontal centerlines are properly aligned. Installation of piping by means of springing, forcing or stressing the pipe or adjacent fittings, valves or equipment will not be allowed.

3.04 MECHANICAL JOINTS AND COUPLINGS

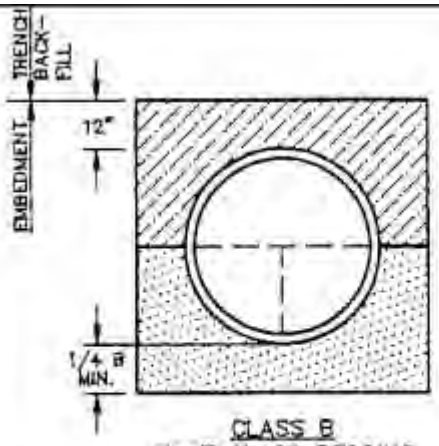
A. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled,

thoroughly cleaned, and reassembled or replaced. Over tightening bolts to compensate for poor installation practice will not be permitted.

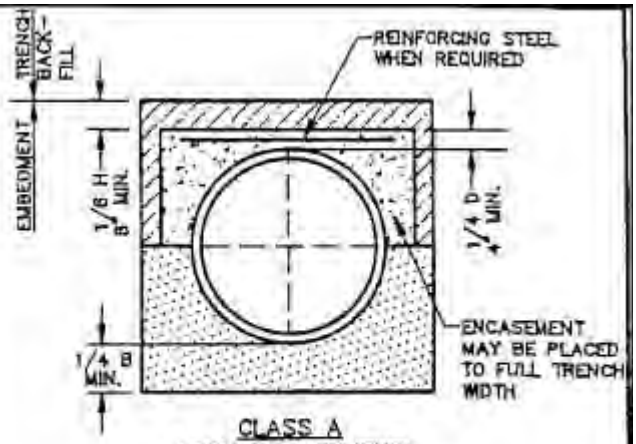
B. The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top (or side for vertical piping) centerline. The top (or side) centerline shall be marked on each flange and mechanical joint piece at the foundry.

3.05 TESTING

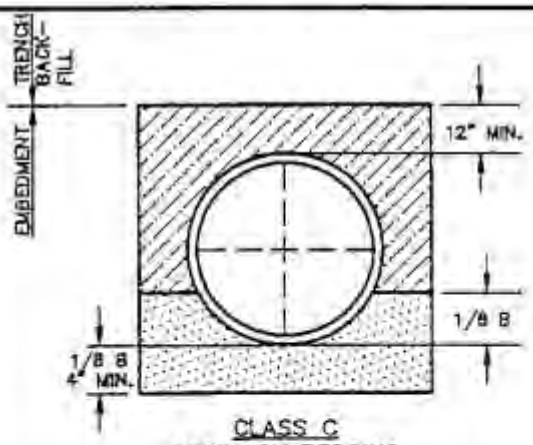
A. All piping shall be cleaned and flushed after completion of installation.



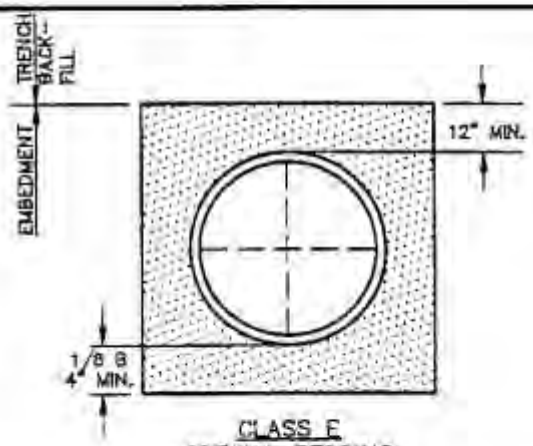
CLASS B
FIRST CLASS BEDDING



CLASS A
ARCH ENCASEMENT



CLASS C
ORDINARY BEDDING



CLASS E
SPECIAL BEDDING

NOTES:

GRANULAR EMBEDMENT SHALL BE SIZE 67 COARSE AGGREGATE ASTM D-33 (SEE SPECIFICATIONS) TO BE PLACED IN NOT MORE THAN 6" LAYERS AND COMPACTED BY SLICING WITH A SHOVEL OR VIBRATING.

COMPACTED EMBEDMENT SHALL BE FINELY DIVIDED JOB EXCAVATED MATERIAL, AND STONES, PLACED IN UNIFORM LAYERS NOT MORE THAN 8" THICK AND COMPACTED TO 95% MAXIMUM DENSITY AS DETERMINED BY ASTM D698; INUNDATED SAND; OR GRADED GRAVEL. GRANULAR EMBEDMENT MAY BE SUBSTITUTED FOR ALL OR PART OF COMPACTED EMBEDMENT.

LEGEND

B	OUTSIDE DIAMETER OF PIPE
H	COVER ABOVE TOP OF PIPE
D	NOMINAL PIPE SIZE
	COMPACTED EMBEDMENT
	GRANULAR BEDDING
	CONCRETE

EMBEDMENTS FOR CONDUITS

HELMS AND ASSOCIATES
CONSULTING ENGINEERS
ABERDEEN, SOUTH DAKOTA

Standard Detail
33 31 00-1

* * * END OF SECTION * * *

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this section.

B. Related Work Specified Elsewhere:

1. Trenching, Backfilling and Compacting - Section 31 23 33
2. Manholes and Castings – Section 33 05 13
3. Standard Detail – 33 41 00-01

1.02 DESCRIPTION OF WORK

A. The work covered under these specifications shall include the furnishing of all labor, material, tools, and equipment necessary to furnish and install, complete in place, all storm water drainage piping and related appurtenances as shown on the drawings and as specified herein. **Storm sewer piping is called out on the plans as PVC. Alternate products preapproved for storm sewer are Reinforced concrete pipe (RCP), polypropylene, or polyethylene (PE), as specified below.**

1.03 SUBMITTALS

A. The Contractor shall submit for review copies of shop drawings for materials specified herein in accordance with the requirements of Section 01 33 23 and the requirements as hereinafter specified.

B. Certificates from the manufacturer that the materials meet or exceed specified requirements.

C. The manufacturer's installation recommendations, including types and amounts of gasket lubricant, where applicable, to be used.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All materials shall be packed, loaded, transported, unloaded and handled in such a manner so as to prevent damage to the materials.

B. All material shall be loaded, unloaded and placed in position by lifting with slings or hoists or skidding so as to avoid shock or damage. Dropping or rolling will not be permitted. The use of end hooks to install or move piping will not be allowed.

C. All materials shall be stored on the site in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforced concrete pipe shall conform to the requirements of Section 990 of the South Dakota Department of Transportation's 2015 Edition of Standard Specifications for Roads and Bridges or newest revision thereof. All reinforced concrete pipes shall be Class 2 unless otherwise stated in the plans.

B. Polyethylene (PE) piping shall conform to the requirements set forth in Part 2.02.

C. PVC storm sewer piping shall conform to the requirements set forth in Part 2.03.

D. Polypropylene storm sewer piping shall conform to the requirements set forth in Part 2.04.

2.02 PE STORM SEWER PIPE

A. Storm sewer pipe will conform to the requirements of ASTM D1248 Standard Specification for Polyethylene (P/E) Plastics Molding and Extrusion Materials and AASHTO M294 Type S.

B. Pipe will be dual-walled with a smooth interior and corrugated exterior.

C. All joints will be gasket style to provide a watertight connection capable of holding a 2.0-psi internal pressure for a minimum of 10 minutes.

D. Fittings for PE pipe will have gasket style joints, be from the same manufacturer as the PVC pipe, and conform to the requirements of ASTM D3350.

E. Tapping saddle tees or wyes may be used for lateral connections.

2.03 PVC STORM DRAINAGE PIPING - SDR 35

A. Polyvinyl Chloride (PVC) gravity pipe shall be Type I, Grade I, conforming to the requirements of ASTM Specification D 3034 for Rigid Poly (Vinyl Chloride) Sewer pipe.

B. Solvent Cement for PVC pipe joints will not be allowed.

C. Gasket type joints shall be made with rubber gaskets conforming to the requirements of ASTM F-477.

2.04 POLYPROPYLENE (PP) CORRUGATED SINGLE WALL PIPE AND DOUBLE WALL PIPE

A. Joints for Polypropylene pipe shall conform to the requirements of ASTM D3212 when water tight joints are required. Fittings for polypropylene pipe shall conform to ASTM F2881, ASTM F2736, or ASTM F2764.

2.05 BEDDING MATERIAL

A. Bedding material shall consist of pit run gravel with a minimum amount of rock retained on the 1" sieve and no more than 15% passing the #200 sieve. The gravel for bedding shall be approved by the Engineer prior to its use.

2.06 STORM SEWER CASTING AND NYLOPLAST INLET

A. Storm sewer inlets shall be PVC structure, 30” diameter, as manufactured by ADS Nyloplast or Pre-Approved Equal. Each drain will be furnished with a “pedestrian” drop-in style casting with a minimum clear opening of 22”. All connections to inlet structures shall be watertight.

PART 3 EXECUTION

3.01 GENERAL

A. Storm drainage piping shall be laid with the groove or bell end of the pipe upstream and the tongue end shall be inserted into the groove.

B. Rubber gaskets at joints shall be installed according to the manufacturer's instructions.

C. Proper equipment shall be provided by the Contractor for lowering the sections of pipe into place. Dropping the pipe into place will not be permitted.

D. Lift holes shall be covered or plugged to prevent backfill from entering the pipe.

E. Nyloplast inlets shall be field cut for final rim elevation of the casting.

3.02 EXCAVATION

A. Trenches shall be excavated to a width sufficient to allow for proper jointing of the pipe and thorough compaction of the bedding and backfill material under and around the pipe. Where feasible, trench walls shall be vertical. The completed trench bottom shall be firm for its full length and width.

B. The foundation for each type of bedding shall be adequate to furnish a uniform stable support. Removal of unstable material or rock below bedding grade shall be performed as set forth in Section 31 23 33.

3.03 BEDDING

A. Bedding shall be used with all storm drainage piping.

1. **Class C bedding, will be used with all concrete storm drainage piping.**
2. **Class B bedding, will be used with all PVC, PE and PP storm drainage piping.**

3.04 BACKFILL ABOVE BEDDING GRADE

A. Pipe shall be backfilled to the elevation shown on the plans or as directed by the Engineer. Backfilling shall conform to the requirements as specified hereinafter.

B. The Contractor shall place backfill material in lifts not exceeding 1-foot and compact to 97% Standard Proctor Density (ASTM D698) at a moisture content between 3% below optimum and 3% over optimum or as directed by the Engineer. Stones equal to or larger than 3-inches in diameter shall not be placed within 2-feet of the pipe.

C. Final 12-inches of backfill material, below flexible surfacing, will be compacted to 98% of maximum density as determined by standard proctor ASTM Test Designation D 698 at moisture content between 5% below optimum and 4% over optimum.

D. Selected embankment material shall be placed along the pipe in layers not exceeding six (6) inches loose depth and thoroughly compacted by mechanical compactors to the required density before successive layers are placed. The width of the berms on each side of the pipe shall be twice as wide as the external diameter of the pipe or twelve (12) feet, whichever is least. This method of backfilling shall be continued until the embankment is at least two (2) feet over the top of the pipe. In trench installations, backfill width shall be equal to trench width. The backfill shall be brought up evenly on both sides of the pipe for its full length.

This method of backfilling shall be continued until the embankment is at least two (2) feet over the top of the pipe.

E. Topsoil shall be replaced to a minimum 6-inch depth upon completion of the embedment operations in grassed areas.

3.05 DISPOSAL OF EXCESS MATERIAL

A. Any excess material, or material determined as unsuitable for backfill, shall be wasted at an area designated by the Engineer.

3.06 TESTING OF GRAVITY STORM SEWERS

A. TEST SECTIONS

1. The alignment tests of all gravity sewer lines shall be carried out on sections of sewer line located between manholes and/or inlets.
2. The Contractor shall be solely responsible for any and all damage to the pipeline, and to public and private property, which may result from defective material or workmanship.
3. Concrete and corrugated metal pipe will not be tested for infiltration or exfiltration, unless specifically called out in the plans.

B. GRAVITY SEWER LINE DISPLACEMENT AND DEFLECTION

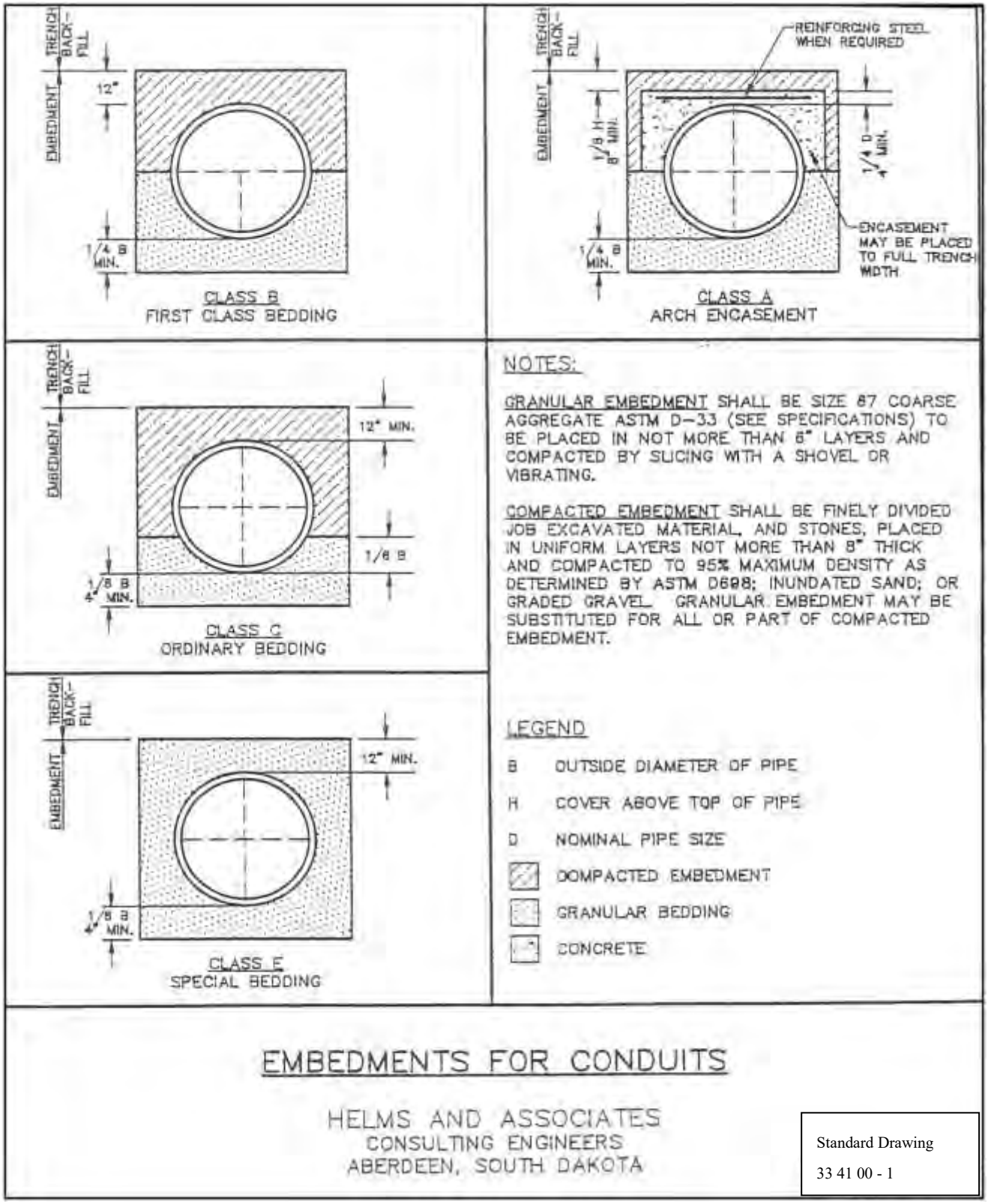
1. All tests for alignment and displacement of the gravity sewer lines will be made after the pipe has been laid and the trench backfilled and compacted as specified.
2. The Engineer's test procedure will be as follows: A light will be shined between manholes and/or inlets by means of a flashlight or by reflecting sunlight with mirrors.
3. The Engineer may require the Contractor to conduct random deflection tests between successive inlet in areas where unstable trench walls or bottoms, heavy rainfall, frozen soil, high ground water levels, deep lines or difficulty in achieving compaction is experienced.

3.07 CLEANING OF GRAVITY SEWER LINES

A. All lines shall be thoroughly flushed and cleaned before acceptance until all traces of construction materials, soil or other foreign matter have been removed.

B. The Contractor shall take all necessary measures to protect adjacent facilities and property. Damages caused by flushing water or water carried material shall be the responsibility of the Contractor.

C. All flushing and cleaning shall be completed prior to the initiation of the testing process described in 3.06.



* * * END OF SECTION * * *

SECTION 01 21 16 – CONTINGENCY ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.

C. Related Sections include the following:

1. Divisions 2 through 16 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

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

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

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

1.4 SUBMITTALS

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

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

1.5 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.6 UNUSED MATERIALS

A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

PART 2 - EXECUTION

2.1 EXAMINATION

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

2.2 PREPARATION

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

2.3 SCHEDULE OF ALLOWANCES

A. Construction Contingency $50,000

B. Exterior Signage $3,000

C. Window Blinds $5,000

D. Landscape Allowance $7,500

END OF SECTION 01 21 16

SECTION 01 33 00 ELECTRONIC SUBMITTAL PROCEDURES

A. Summary:
   1. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format using Submittal Exchange, a website service designed specifically for transmitting submittals between construction team members.
   2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
   3. The electronic submittal process is not intended for color samples, color charts, or physical material samples.

B. Procedures:
   1. Submittal Preparation - Contractor may use any or all of the following options:
      a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the Submittal Exchange website.
      b. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
      c. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
   2. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
   3. Contractor shall transmit each submittal to Architect using the Submittal Exchange website, www.submittalexchange.com.
   4. Architect / Engineer review comments will be made available on the Submittal Exchange website for downloading. Contractor will receive email notice of completed review.
   5. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
   6. Submit paper copies of reviewed submittals at project closeout for record purposes in accordance with Closeout Submittals

C. Costs:
   1. *General Contractor shall include the full cost of Submittal Exchange project subscription in their proposal. This cost is included in the Contract Amount. Contact Submittal Exchange at 1-800-714-0024 to verify cost prior to bid.*
   2. At Contractor's option, training is available from Submittal Exchange regarding use of website and PDF submittals. Contact Submittal Exchange at 1-800-714-0024.
   3. Internet Service and Equipment Requirements:
      a. Email address and Internet access at Contractor's main office.
      b. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01 50 00 - GENERAL REQUIREMENTS:

SCOPE OF WORK:
The prime contractor shall furnish all labor, materials, equipment and service and perform all of the work of each respective contract as shown on the drawings and specified in the specifications prepared by HKG Architects, Inc., AIA, Aberdeen, South Dakota and their consulting engineer*s.*
Contractors shall, prior to start of work, set the work schedule and sequence with the owner and secure approval of same.
Suitable access to and from existing building and all other areas must be provided at all times.
Prime contractors shall cooperate with each other to insure a smooth running, well organized project.

COMMENCEMENT AND COMPLETION OF WORK:
The general contractor shall commence work under this contract within ten (10) calendar days after the Notice to Proceed has been received by him and prosecute the work diligently so as to complete the work within the time stated in the contract documents.
Mechanical and electrical contractors shall coordinate their work to coincide with the schedule and progress of the general contractor.

WORK NOT INCLUDED:
The items marked N.I.C. (Not in Contract) on the drawings are to be furnished and installed by the owner under separate contracts The general, mechanical and electrical contractors, shall, however, provide all openings, outlets and connections for these items as shown or noted on the drawings.

SUBSTITUTION OF MATERIALS:
The base bid and listed alternates shall include only the materials listed in the specifications and/or addenda. All requests for approval of material substitutions must be submitted, in writing, to the architect not less than ten (10) days before the bids are to be received. All such requests must be accompanied by complete descriptive literature marked to show exactly what is proposed. Failure to submit complete marked literature may be grounds for rejection. Any and all material approved for use will be listed in addenda and issued to all plan holders prior to bid date.

PUBLISHED SPECIFICATIONS AND STANDARDS:
Any material or operation specified by reference to the published specification of a manufacturer or other Institute or Industry specifications or standards shall comply with the requirements of the specifications or standards listed.

EXAMINATION OF SITE-:
Bidders are requested to visit the site and to compare the drawings and specifications and inform themselves of all conditions possible. Failure to visit the site shall in no way relieve the successful bidder from necessity of furnishing any materials or performing any work that may be required to complete work in accordance with the drawings and specifications without additional cost to the owner.

BARRICADES AND PROTECTION OF PUBLIC:
The general contractor shall erect-and maintain in good condition, suitable barricades for the protection of the public around the entire construction area. All barricades shall be erected immediately upon starting the work and shall be maintained throughout the construction period. Provide lights or flares if required. Protection and barricades shall meet the approval of the owner, the architect and local ordinances.

LAYING OUT WORK:
The contractor shall immediately upon entering project site for purpose of beginning work, locate all general reference points and take such action as is necessary to prevent their destruction, lay out his work, and be responsible for all lines, elevations and measurements of the building, grading, paving, utilities and other work executed by him under the contract. He must exercise proper precaution to verify figures shown on drawings before laying out work and will be held responsible for any error resulting from his failure to exercise such precaution.

TEMPORARY UTILITIES:

HEAT:

1. The general contractor shall furnish heat as required to prevent injury through dampness and cold to the work and/or materials. He shall maintain a temperature of at least 40 degrees F. at all times during the setting of concrete. For ten days prior to the placing of the interior wood finish, and during the time paint and varnish and other interior finishes are being applied, a minimum temperature of at least 70 degrees F. shall be maintained in the building. The use of salamanders or other type of heating which may smoke and damage the finished walls, etc., will not be allowed after the building is enclosed. Temporary vented type furnaces may be used after the building is enclosed.
2. Permanent heating plant may be used for temporary heat when it is ready for use. General contractor shall be responsible for its operation during this time. Fuel and Electrical will be paid for by the Owner. This responsibility does not include faulty equipment or installation of the system. The mechanical contractor is solely responsible for the correct installation of all mechanical items. General contractor shall include in the cost of temporary heat the complete cleaning of the equipment and a new set of filters for each unit having filters, prior to turning building over to owner.
3. Cost of temporary heat shall be paid for exclusively by the general contractor until such time as the building is enclosed.
4. The general contractor shall be relieved of furnishing temporary heat upon substantially completing his portion of the work, as determined by the architects. Thereafter, if any other contractor needs or desires temporary heat, it shall be the responsibility of the respective contractor. If none of the contractors need temporary heat after substantial completion, the owner will then arrange to furnish heat for the building.

ELECTRICITY:

1. The general contractor shall make necessary arrangements for temporary electric service, electrical energy and pay the expense in connection therewith. The contractor shall furnish, install, connect and maintain all temporary electrical lines for light and power purpose as required for completion of the work. All lamps used in permanent fixtures during construction shall be replaced with new lamps.

WATER:

1. Water will be provided at no cost to the contractor. This service will be available at connections on the present building. The general contractor shall furnish all hose, connections etc. to utilize this service and shall guard against waste. Remove all items when no longer required.

USE OF PREMISES:

The contractor shall protect the existing buildings from any and all damage during this work and if damaged, shall repair same to its original condition as approved by the architect.

The contractor shall confine his apparatus, the storage of materials and the operation of his workmen to limits indicated on the plot plan, by law, ordinances, permits or directions of the architect and shall not unreasonably encumber the premises with his materials.

The contractor shall not load or permit any part of the structure to be loaded with a weight that will endanger its safety.

Under no conditions shall workmen of any contractor or any of the subcontractors use any portion of the buildings as temporary living quarters.

TEMPORARY TOILET:

General contractor shall arrange for temporary chemical toilet facilities on the site and shall at all times keep site in a sanitary condition. As soon as work will allow, provide a temporary toilet inside the building, connect same to sewer, keep in sanitary condition and maintain privacy.

MAINTENANCE MANUALS AND INSTRUCTIONS:

Before final payment, furnish to owner through the architect, all manufacturer's literature and/or manuals of instruction for installation, proper care and maintenance of materials and equipment installed under the contract. In addition, and when so requested, instruct owner's maintenance personnel as to such care and maintenance. Electrical and mechanical operating instructions specified under their respective divisions.

RECORD DRAWINGS:

As the work proceeds, keep a careful record of piping and other concealed work whose installed locations vary from those shown on contract drawings, whether because of change orders or job conditions. Mark such variations on prints furnished by architect, and deliver to him before final payment.

FINAL INSPECTION:
Upon completion of the work, the contractor shall notify the architect by letter and make arrangements for a final inspection. After the architect's final inspection is made, the contractor will receive a list of items requiring adjustment, correction, replacement or completion.
The contractor shall comply completely with all the listed requirements within forty (40) days of receipt of list. Should the contractor fail to perform within this time limit, the architect and/or owner reserves the right to have the work completed by others and the cost deducted from the contract price.

TEMPORARY ENCLOSURES:
The general contractor shall provide and install temporary weather tight enclosures for all exterior openings as soon as walls and roof are built to protect work from weather. Equip exterior doors with self-closing hardware and padlocks.
Provide and install temporary sash frames or enclosures for all exterior window openings. Fasten securely in place but capable of removal when required.

TEMPORARY PARTITIONS:
The general contractor shall erect temporary dustproof partitions at any openings being remodeled or cut in the public corridors. The projection into the corridor shall be kept to a minimum so as not to interfere with the normal flow of traffic.
Partitions shall remain in place until all dust producing operations have been completed. Protect existing surfaces remaining and repair any damage to same. Partitions to be constructed of 2 x 4 spaced 24" O.C. with polyethylene film over the top and securely fastened in place.

DELIVERY AND PROTECTION OF MATERIALS:
Deliver all materials in the original packages, containers, crates and bundles, bearing the name of the manufacturer and the brand. Except as otherwise specified herein, the mixing, installation and application of materials shall be in strict accordance with the printed directions of the manufacturer and supplier.
Store materials off the ground, under cover from dampness. Exercise care in handling units to avoid-chipping, abrasion and breakage. Locate storage piles, stacks, or bins to protect materials from damage, rust, contamination and avoid being disturbed. Confine storage of materials to areas designed by the owner and architect.

APPLICATIONS FOR PAYMENT:
Prior to submitting the first application for payment, each contractor shall submit a "Schedule of Values" in four (4) copies. This schedule shall contain a complete and detailed list of the various items upon which payments will be requested. AIA Form G703 may be used.
Applications for payment shall be submitted in three (3) copies using AIA Forms G702 and G703. All items are to be completed and forms signed.

TEMPORARY BUILDINGS:
The contractor shall, at his expense, furnish all temporary buildings during the construction period.

1. Office: The general contractor shall erect or bring onto the property, maintain in good condition, and remove when directed, weather tight office for his use and representatives of the architect and owner. It shall be adequately heated and electrically lighted. The contractor shall maintain a listed telephone with construction bell at the temporary office. Cellular phones will be acceptable.
2. Storage Buildings: The contractor may construct or bring onto the property such storage buildings as necessary to protect materials, tools or equipment for use on the project. Such buildings shall meet with the approval of the architect and the owner and shall be removed from the site upon completion of the respective contractor.

DISCREPANCIES, ERRORS AND OMISSIONS:
In the event any error, omission or discrepancy in or between drawings and specifications exist or appear to exist, the contractor shall not attempt to profit from such obviously unintentional error but shall have same explained or adjusted by the A/E before submitting his proposal. In the event such clarification is not obtained, the contractor shall be deemed to have estimated the work as follows:

Discrepancies between the drawings and specifications, the specifications shall govern.

Discrepancies between schedule and other drawings, the schedules shall govern.

Discrepancies between drawings, the drawing at the larger scale shall govern.

Materials shown on drawings but not described in the specifications, the drawings shall govern.

Discrepancies between manufacturer's printed installation instructions and the project specifications, the manufacturer's installation instructions shall govern

MEASUREMENTS:
Before ordering any material or doing any work Contractor shall verify all measurements at the project and shall be responsible for the correctness of same. No extra charge or compensation will be allowed on account of difference between actual dimensions and the measurements indicated on the drawings. Any difference which may be found shall be submitted to the A/E for consideration before proceeding with the work.

MATERIALS REMOVED:
Usable salvaged material, doors, windows, fixtures, etc. not reused in the work shall remain the property of the owner and shall be stored on the site where directed by the owner.
Rubbish and debris shall be promptly removed from the site and shall be legally disposed of. Do not permit rubbish and debris to accumulate.
All the equipment or material to be removed shall be removed by the contractor and shall be stored where directed and, at the owner's option, shall remain the property of the owner; however, if the owner elects not to retain ownership, then it shall become the property of the contractor who shall remove it from the premises.

DESTRUCTION OF SURVEY MONUMENTS**:**

The general contractor shall be responsible for the safety and protection of all survey monuments that dictate the particular project's boundary corners. If in the course of construction said monuments are destroyed, the general contractor shall be held responsible for replacement. If replacement is ruled necessary, the contractor shall, prior to final payment, obtain the services of a licensed surveyor who shall re-establish all such monuments with reference at no cost to the owner.

PROTECTION:
Protection in General: Protect trees, shrubs, lawns, landscape work from damage; provide guards, covering. Protect streets, sidewalks, private roads, walks; maintain them during course of work; repair all damages without extra cost to the owner.
Weather and Wind Protection: Provide constant protection against rain, high water table, wind, storms, frost or heat so as to maintain work materials, apparatus, fixtures, free from injury or damage. At end of day's work, cover work likely to be damaged.
During cold weather protect work from damage, Remove work damaged by failure to provide protection; replace with new work without extra cost to the owner.
Protection of Existing Building: This contractor shall be responsible for undue damages to existing building as well as items inside building during construction period. Should any damage occur, this contractor shall replace or repair the same to the satisfaction of the owner and architect. Any such repair work shall be accomplished using workmen specially skilled in the trade involved.

ASBESTOS-CONTAINING MATERIALS STATEMENT:
In accordance with the provisions of SDCL 34-44-8, all bidders and contractors are hereby notified that this project does not involve asbestos-containing materials. Bidders are further instructed that no asbestos-containing materials are to be installed in this project.
Should asbestos-containing materials be encountered, owner and architect shall be notified immediately so owner can have it removed by a licensed asbestos removal contractor and legally disposed of.

END OF SECTION.

SECTION 02 32 00 – SOIL INVESTIGATION REPORT:

GENERAL NOTES:

Soil Technologies, Inc. performed a soil investigation at this site and a copy of their report consisting of 39 pages follows this page.

SITE INFORMATION:

The date on indicated subsurface conditions is not intended as representations or warranties of the continuity of such conditions. It is expressly understood that the owner will not be responsible for interpretations or conclusions drawn there from the contractor. The data is made available for the convenience of the contractor.

Additional test borings and other exploratory operations may be made by the contractor at no cost to the owner.

HKG ARCHITECTS, INC.
ABERDEEN, SD

Electronic File Copy 10-14-2021

SOIL EXPLORATION PROGRAM
PROPOSED STUDENT UNION ADDITION
SW COLLEGE
NEAR SISSETON, SD

STI #21-1714

October 14, 2021

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STI #21-1714

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Boring Location Drawing
Borings Logs
Field Exploration Procedures & "Descriptions"
Symbols and Terminology
Precautions...During Cold Weather
Construction Observation and Testing
Important Information about Your Geotechnical Report

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SOIL EXPLORATION PROGRAM

PROPOSED STUDENT UNION ADDITION

SW COLLEGE

NEAR SISSETON, SD

STI #21-1714

Electronic File Copy 10-14-2021

1.0 INTRODUCTION

1.1 Project Information

We understand the proposed project will consist of the construction of a Student Union building addition at the Sisseton Wahpeton College, 7 miles south of Sisseton, SD. The proposed building will consist of a single-story (with a clear upper-level), slab-on-grade (no below grade floors or crawl space), heated structure. It will be located between the existing Vo-tech and main college buildings. The proposed building will have overall dimensions of about 115 x 140 feet.

The analysis and recommendations provided in this report are based on the above information and the following conditions:

- The finished floor elevation of the proposed building will be within about 2 feet above the existing grades and be at an elevation between 99.0 and 101.0 feet.*
- The perimeter frost footings of the building will rest at 5 to 6 feet below the finished floor and be at an elevation between 93.0 to 96.0 feet.*
- The new perimeter finished grades immediately surrounding the building will be below the finished floor elevation.
- Column loads will be a maximum of 160 kips (total dead and live loads) with continuous footing loads less than 5 kips/ft (total dead and live loads).
- Uniform floor slab loadings exerted on the underlying soils will be a maximum 500 pounds per square foot (psf).

**Elevations based on the survey benchmark shown on the attached sketch.*

2.0 ENGINEERING REVIEW

The engineering recommendations provided in this report are based on the soil information obtained under this Soil Exploration Program along with the information and conditions of the

project as described above. The recommendations are valid for the specific information and conditions listed. If there are additions, corrections, or changes to the above information or conditions, it is necessary that we be notified so that we can determine whether the new information or conditions affect our recommendations.

Our design assumptions include a minimum theoretical safety factor of 3 with respect to shearing or base failure of the foundations. We assume an allowable total settlement of 1 inch and a differential settlement of up to 1/2 inch over a length of 30 feet.

The recommendations in this report assume the location of the proposed building is within 50 feet of the boring locations as shown on the attached sketch. If the location of the proposed building is changed so as not to be within this distance for each of the respective borings, we must be contacted for additional review and potentially additional borings.

Electronic File Copy 10-14-2021

2.1 Discussion

- **Soil Profile**

The boring logs suggest that the general soil profile in the building area consists of 2 to 4.3 feet of clay "fill" soils and clay "topsoil" overlying mostly native clay "till" (glacial deposited soils). The "till" soils extended to the termination depths of the borings at 16 to 31 feet below the existing grades. Some native clay "alluvium" (water deposited soils) were encountered immediately below the "fill" soils and "topsoil." Please see Figure #1 below and the attached boring logs.

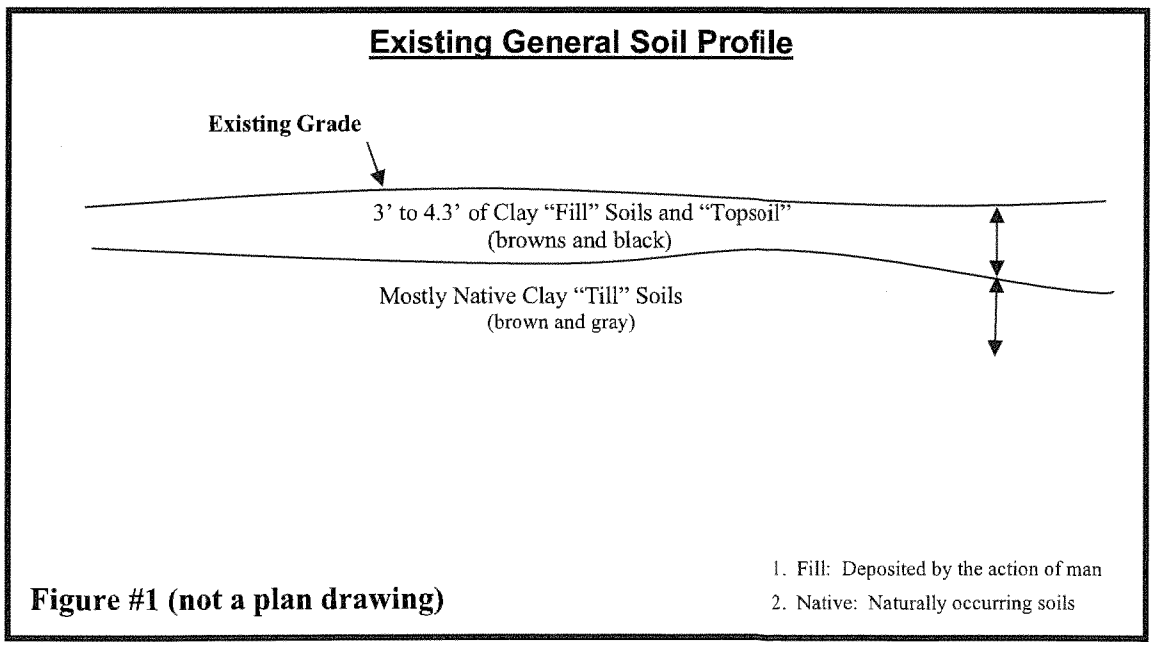

Figure #1 (not a plan drawing)

- **General**

Based on the subsurface conditions encountered at the boring locations, it is our opinion that the soils at the site will support the proposed structure on shallow spread footing foundations, provided the recommendations in this report are performed and the estimated settlements are acceptable. Listed below are some of the more prominent site conditions.

- **FOOTING AND FLOOR AREAS**: "Fill" soils and "topsoil" were encountered at the site and extend from the surface to depths of 2 to 4.3 feet below the exiting grades. In our opinion, these soils are not suitable for support of the footings and floors and should be removed from the footing and floor areas.

- **FAT CLAY SOILS:** Native fat clays soils were encountered in the borings. Fat clay soils typically have a potential for movement (swelling and shrinkage) with a change in the in-situ moisture content. The movement of fat clay soils can cause the footings or floor slabs of a structure to be displaced, which can result in structural distress. The potential movement of the fat clay depends on a number of uncontrolled variables such as climate conditions at and after the time of construction, long term fluctuations of the groundwater level, construction backfill methods, utility line leakage, landscaping, sprinkling (watering) of plants and lawns, and other similar aspects.

  Based our experience with similar soils, the laboratory test results, and calculated liquidity index, it is our opinion that the fat clay soils encountered at this site generally have a moderate to high potential for movement with a change in the in-situ moisture content. Therefore, they present a significant risk of moisture related movement and subsequent structural distress to the proposed building.

  A common method to significantly reduce and nearly eliminate the risk of structural distress, (due to moisture related movement of the fat clay) is to support the entire structure (all structural components including the floor slab) on a deep foundation system such as drilled piers or pile. In general, the cost of installing a deep foundation system is typically much higher than the cost of normal spread footing foundations. As an example, drilled piers would extend to a depth of about 20 to 25 feet below the existing grades.

  An alternative, (but higher risk method) to reduce the risk structural distress is to perform an "excavate refill program" below the structure. The excavate/refill program typically consists of placing a 3 to 5-foot layer of non-expansive engineered fill soils between the structural components of the building and the fat clay. The purpose of placing the non-expansive engineered fill below the structure is to provide a "buffer zone" between the fat clay and the

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structural components of the proposed structure. This buffer zone will reduce (mitigate) the potential of movement and subsequent distress to the proposed structure, but it will not eliminate it. (Keep in mind that the excavate/refill program requires above normal monitoring and workmanship of all earthwork activities.)

The decision as to which method to use (the deep foundation system or the 3 to 5-foot excavate/refill program) and their corresponding risks, is that of the owner/client. This report provides recommendations relative to the excavate/refill program along with typical shallow spread footings construction. Please contact us if you desire more information about supporting the structure on deep foundations. Also, please be aware that additional laboratory tests, such as "pressure-swell" tests can be performed to further verify the severity of the fat clay's potential to move and cause distress.

2.2 Site Preparations

Assuming the owner desires to support the proposed building on typical shallow spread footings and to reduce (but not eliminate) the risk of structural distress due to potential movement of the fat clay soils, we recommend the following site preparations:

FOOTINGS (Interior, Exterior, & Thickened Edged): In our opinion, the existing "fill" soils and "topsoil" should not be used for support of the footings. In addition, the native clay "till" soils and some of the native clay "alluvium" soils present a risk of movement and subsequent structural distress and should not be used for direct support of the footings. Instead, an excavate-refill program should be performed to provide a "buffer zone" between the native clay soils and the proposed footings. Therefore, we recommend that site preparations for all footings should consist of the excavation of the existing "fill" soils and "topsoil" which extend to depths of 2 to 4.3 feet below the existing grades. In addition, in order to create a "buffer zone," the footings excavations should extend below the footings and into the native fat clay "till" soils to a depth of at least 3 feet below the design footing grade. (For example, if the footings are designed to rest at an elevation of 95.0 feet, the footing excavation should extend to an elevation of 92.0 feet.)

Once adequate excavation depths are reached and the strength of the exposed native soils are judged adequate by the on-site geotechnical engineer, the footing excavations should be refilled with at least 3 feet of engineered fill (fill soils that have been compacted and tested to the specified density) to meet the design footing grade elevations. The footings should be constructed to rest

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on at least 3 feet of the engineered fill. Please refer to Figure #2 on page 6 showing "Typical Building Site Preparations." Also, please refer to page 8 for the type of engineered fill.

FLOOR SLAB: Similar to the footing areas, site preparations for the floor slab area should consist of the excavation of the existing "fill" soils and "topsoil" which extend to depths of 2 to 4.3 feet below the existing grades. In addition, in order to create a "buffer zone," the floor area excavations should extend below the floor and into the native clay "till" or "alluvium" soils to a depth of at least 4 feet below the design floor grade. (For example, if the floor slab is designed to rest at an elevation of 100.0 feet, the floor slab excavation should extend to an elevation of 96.0 feet.)

Once adequate excavation depths are reached and the strength of the exposed native soils are judged adequate by the on-site geotechnical engineer, the floor excavations should be refilled with at least 4 feet of engineered fill (fill soils that have been compacted and tested to the specified density) to meet the design floor grade elevations. The floor should be constructed to rest on at least 4 feet of the engineered fill. Please refer to Figure #2 on page 6 showing "Typical Building Site Preparations." Also, please refer to page 8 for the type of engineered fill.

MOISTURE CHANGES: To limit the potential of movement (expansion or shrinkage) of the fat clay, it is important that the moisture content of the fat clay soils exposed at the bottom or along the sidewalls of the footing and floor excavations be maintained. Significant drying or wetting of the fat clay may increase their potential for movement and subsequent structural distress. To prevent moisture changes, especially drying, the fat clay soils may need to be covered with engineered fill or with other protective methods as soon as practical. If significant drying or wetting of the fat clay occurs, we recommend you contact us prior to placement of engineered fill, structural components, etc.

BUFFER ZONE: The above listed site preparations will result in leaving some of the native fat clay soils in-place below the footings and floor slab. Thus, as noted above, although the placement of 3 to 4 feet of engineered fill will reduce the risk by acting as a "buffer zone," there will still be some risk of structural distress due to the potential movement of the fat clay that is left in-place. Also, we wish to emphasize that the depth (thickness) of the clay engineered fill placed below both the footings and floor slab can be increased to more than 3-4 feet. An increase in the depth of clay engineered fill placed below the footings and floor slab generally lessons the risk of structural distress due to moisture changes of the fat clay. The decision as to the depth of clay engineered fill placed below the footings and floor slab is that of the owner.

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- **Soil Disturbance**

The soils encountered at the site can be sensitive to disturbance, especially when their moisture conditions are high. Care should be taken not to disturb the soils underlying the footings, floor slabs, or other structural units. If disturbed, they should be completely excavated from these areas and replaced with engineered fill, or if the disturbance is shallow, recompacted in-place and density tested. Also, the site preparations should include complete removal of all remnants of any previously existing structures, utilities, tree roots, etc. Excavations to remove these items, or other intrusions (accidental, deliberate, or otherwise) into the soils underlying the footings or floor slab, should be backfilled with engineered fill and compacted to the specified density.

Typical Building Site Preparations

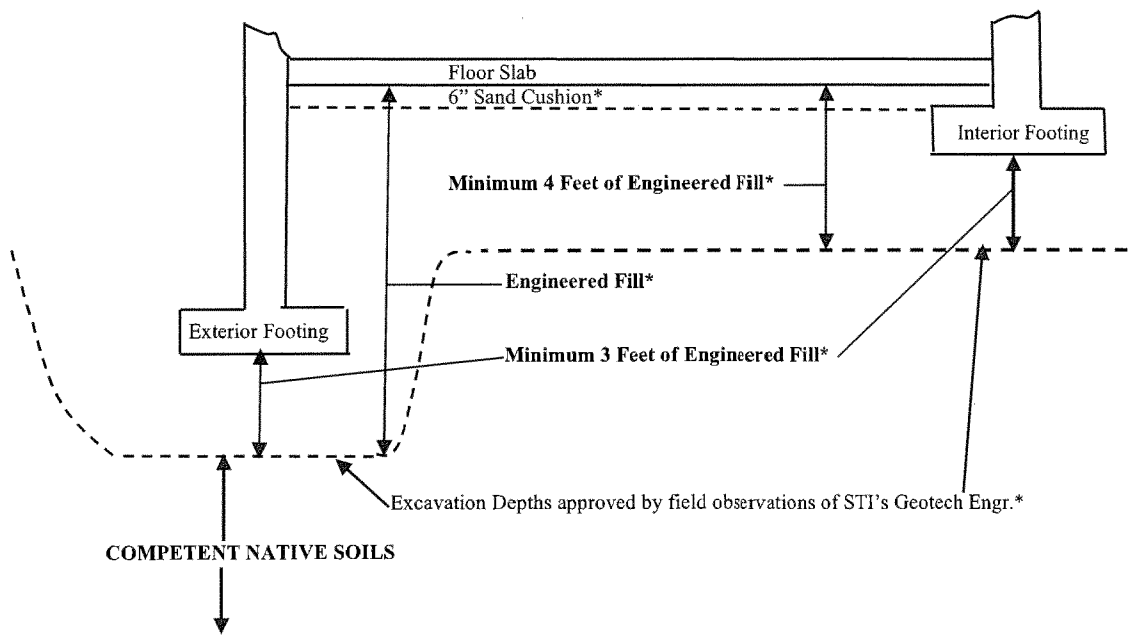

Figure #2 (not a plan drawing)

*Specific specifications listed in this report.

- **Excavation Oversize Requirements**

Engineered fill placed below the footings should be oversized 3/4 foot laterally for each foot of fill placed below the footings (extend the excavation outwards from the outer edges of the footings a distance of 3/4 foot for every 1 foot of fill placed below the footings). The maximum lateral over-excavation required is 1.5 times the width of the footing. Please see Figure #3 below illustrating the excavation oversize requirement.

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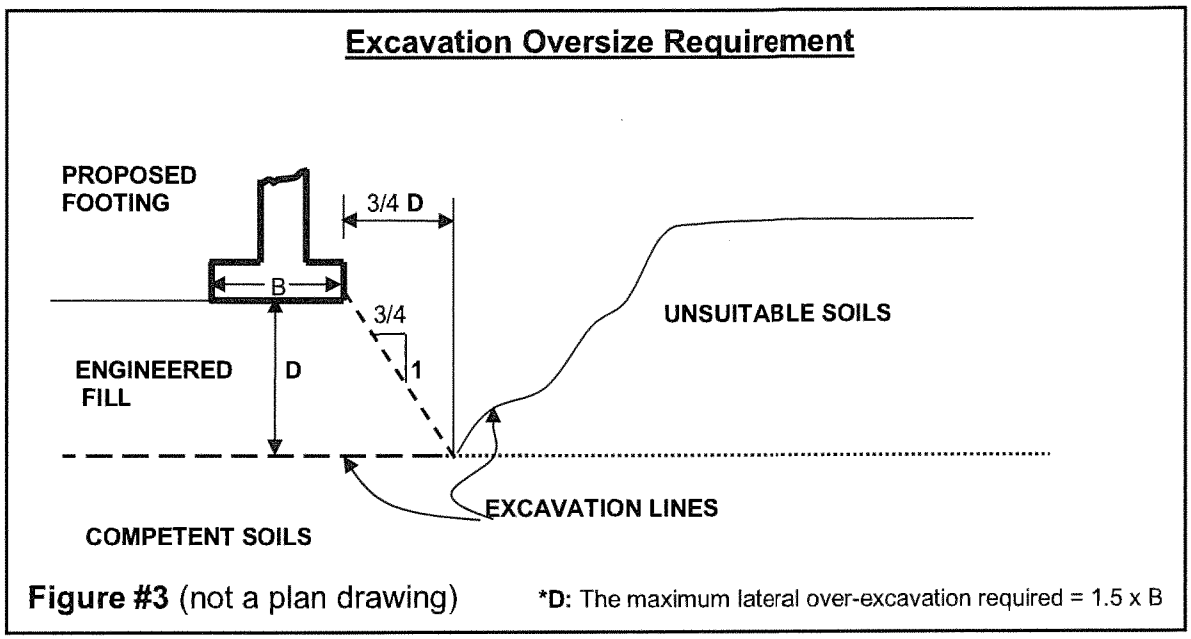

Figure #3 (not a plan drawing) *D: The maximum lateral over-excavation required = 1.5 x B

- **Utility Trenches**

Utility trenches within the building footprint (and in structural areas outside the building footprint) should be refilled with engineered fill. The engineered fill should be compacted and tested to the specified density. In addition, utility trenches should not be placed within the influence zone of the footings, including the influence zone of thickened edge footings. Please see to Figure 4 below. If it is necessary to install a utility by crossing beneath a footing, that portion of the utility trench below the footing should be refilled with a lean concrete mix (flowable fill).

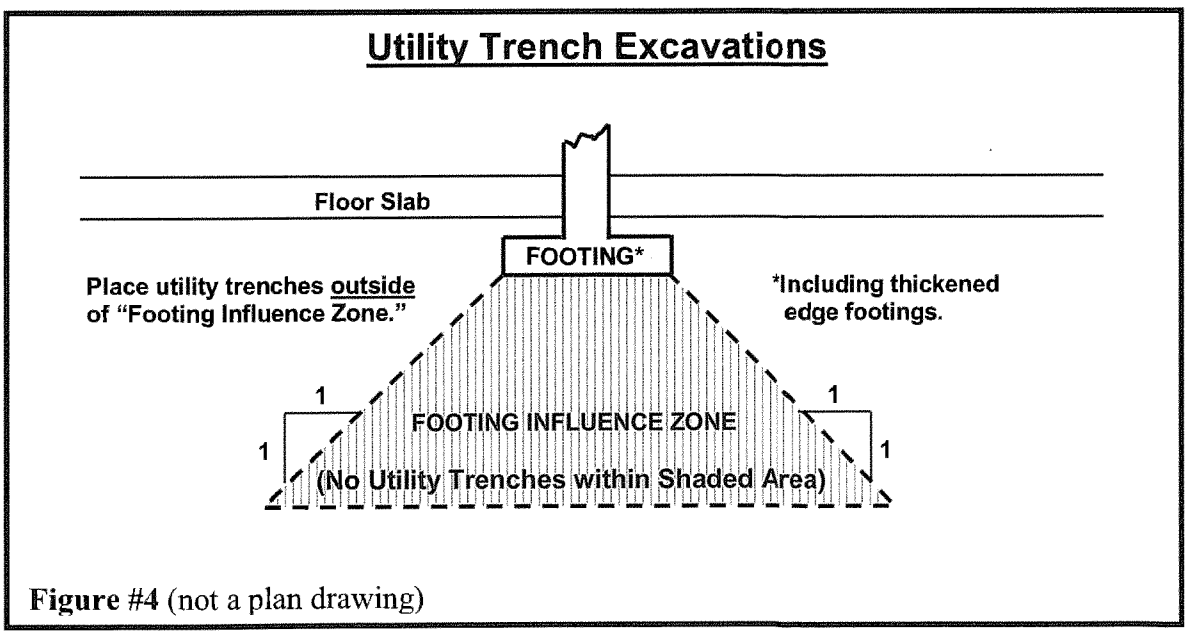

Figure #4 (not a plan drawing)

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- **Engineered Fill Below Foundation and Floor Areas**

We recommend the following types of engineered fill and compaction of engineered fill.

NOTE: Soils are classified as sand if more than 50% are retained on the #200 sieve.

Above and below the footings and more than 6 inches below the bottom of the floor slab (including utility trenches):	**Primary Recommendation - Use Only Lean Clay:** In moist to dry excavations, use a lean clay (CL) engineered fill. The lean clay should have a liquid limit of less than 43 and a plasticity index of at least 16. **Higher Risk Alternative:** In moist to dry excavations, a dirty granular soil such as a silty sand (SM) or clayey sand (SC) could be used. The sand should have 25% to 50% passing the #200 sieve, a maximum gravel size of 3 inches and a liquid limit less than 43%. **Note**: In our opinion, the use of a granular soil for engineered fill increases the risk of moisture reaching the fat clay soil and thus, increases the risk of structural distress to the proposed building. The decision to use sand as engineered fill and accept the associated higher risk is that of the owner. **NOTE the following:** - The on-site, fat clay soils (CH) are NOT suitable as CL engineered fill. - Organic soils (topsoil) should not be used for engineered fill.	
6-inch sand cushion below floor slab:	The final 6" of engineered fill directly beneath the floor slab should consist of free draining sand (SP or SW) having a maximum gravel size of 1" and with less than 10% passing the #200 sieve by weight. The purpose of the sand cushion is to provide a working surface for the placement of concrete and also to serve as a capillary barrier.	
Compaction of engineered fill: (Less than 10 feet total thickness)	- Below Footings and in the footing influence zone (pg. 7): - Below Floor Slabs: - Utility Trenches (inside & within 10' outside of the building):	**Minimum % Compaction** - 97% of the ASTM: D698* - 97% of the ASTM: D698* - Same as "Below Floor Slabs" *Standard Proctor Density

- **Compaction Equipment and Placement of Engineered Fill**

Engineered fill should be compacted in maximum 12-inch loose lifts using heavy, self-propelled compaction equipment, or maximum 6-inch loose lifts using hand-operated compaction equipment. Clay engineered fill should be placed at a moisture content ranging from -4% to +2% of the optimum moisture content as determined by the Standard Proctor (ASTM: D698). The

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moisture content of the clay soils should be maintained until placement of the footings and floor slabs. The engineered fill should be free of frost and should not be placed on frozen soils. Please refer to the attached "Precautions...During Cold Weather."

- **Geotechnical Engineer's Observations**

Soil types and strengths can sometimes vary around and in-between the borings. Some soils may not be as competent for support of the proposed building as those encountered in the borings. Therefore, we recommend that the soils exposed in the final footing and floor area excavations of the proposed structure(s) be observed in the field by a Geotechnical Engineer from Soil Technologies, Inc (STI). The Geotechnical Engineer will compare the exposed soils with the soils listed on the boring logs of this report to determine if they are the correct soil types and strengths. Once the type and strength of the soils exposed in the excavations are judged competent by STI's Geotechnical Engineer, the engineered fill, concrete footings, and floors can be placed as needed. STI's Geotechnical Engineer will provide a written report detailing the observations of the exposed soils in the footings and floor slab areas. **The general contractor or owner's representative should contact STI's Geotechnical Engineer to perform these field observations prior to the earthwork phase of the project.**

Note: This report and its recommendations are a <u>two-step process</u>. The first step is the implementation of the recommendations of this report <u>during the design</u> of the project. The second step is the implementation of these recommendations <u>during construction</u>. **The second step is critical to the success of the project, and it must include the field observations of the soils by STI's Geotechnical Engineer**. It has been our experience that the lack of field observations by the Geotechnical Engineer during the earthwork phase of the project can result in oversight, in part or in whole, of the recommendations of the soils report. Therefore, the absence of our field observations of the soils during the footing and floor area excavations shall relieve us of the responsibility of the work performed during that portion of the project and its effect on related components.

- **Polyethylene Vapor Membrane (Slab-on-grade)**

We recommend that consideration be given to placing a polyethylene vapor membrane beneath the floor slab, especially if there are areas where moisture/sensitive floor coverings are planned. If used, consideration should be given to the potential of curling of the concrete floor due to the presence of the membrane. Placing the membrane at least 2 inches beneath the surface of the

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sand cushion can help to minimize the potential for curling of the concrete floor. The use and placement of the membrane should be decided by the architect or structural engineer of record.

- **Subgrade Modulus**

Placement of engineered fill soils from the bottom of the excavation to the design slab elevation will generally increase the overall modulus. The amount of increase is dependent on the type and depth of engineered fill placed. A granular engineered fill would generally provide a higher modulus than clay engineered fill. For design purposes, we have provided estimated subgrade modulus ("K") values as listed below in Table 1. The subgrade modulus values are assumed to be at the surface of the described soil type compacted to at least 97% of the Standard Proctor density (ASTM: D698). Please note that these values are only estimates based on soil types and densities. "Plate Load Tests" should be performed to provide specific "K" values.

TABLE 1

Soil Type (Minimum 97% Compaction) and/or approved by the on-site Geotechnical Engineer)	Depth of Engineered Sand Soils	Estimated Subgrade Modulus (pci)*
Engineered Sand Soils over Lean Clay Soils	6" to 9"	130
Engineered Sand Soils over Lean Clay Soils	9" to 12"	170

*Values should be reduced (up to 40%) for exterior pavements used for traffic during frost melting periods.

- **Frost Movement Below Slabs**

The existing clay soils likely have a moderate to high susceptibility of frost related movement. Placement of rigid insulation sheeting under at least 10 inches of free draining granular fill might be considered to limit frost related movements of the unprotected surfaces.

2.3 Foundations

- **Allowable Soil Bearing Pressure**

Providing the owner/client assumes the risk of the building distress, it is our opinion, the proposed structure can be supported on a shallow spread footing foundation system (column pads and/or strip footings). We recommend that the footings be designed using **an allowable soil bearing pressure of up to 3000 psf.**

The allowable soil bearing pressure listed above assumes that the site is prepared as recommended in section 2.2 Site Preparations and that the project is constructed as per the information and conditions listed in section 1.1 Project Information. **If the project**

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information or conditions are changed, STI must be notified in writing for additional review.

The allowable soil bearing pressure is based on our judgment of the soil conditions at the boring locations along with recommended compaction levels and our experience with similar soil conditions. The allowable soil bearing pressure is a net pressure and can be increased 30% for short-term loadings such as wind loads.

- **Foundation Settlement**

The recommendations in this report should provide a theoretical safety factor of at least 3.0 against localized shear failure of the foundations. Long term total settlements of the building footings are estimated to be less than 1 inch with estimated differential settlements less than ½ inch over a 30-foot length.

The above estimated settlements are based on the above recommended soil bearing pressure, the site being prepared as recommended in section 2.2 Site Preparations, and the project being constructed as per the information and conditions listed in section 1.1 Project Information. Pleases note that, the total and differential settlement of the footings (and floor slab) could be significantly greater than the above estimates if improper construction practices are used. These practices may include but are not limited to: allowing snow or ice to be incorporated into the engineered fill soils, allowing the soils below the footings or floor to be saturated or freeze prior to or after their placement, inadequate compaction of engineered fill soils, supporting the footings or floor slab directly on expansive soils such as fat clay (CH) or on soils that were inadvertently loosened during construction, etc.

- **Frost Depth**

For structures that are heated during their entire life, the exterior footings should be placed at a frost depth as per city code, or a minimum 4½ feet below finished grade. Interior footings can be placed at shallower depths provided they are protected from frost during and after construction. For unheated structures, canopies, etc., both the exterior and interior footings should be placed at least 5½ feet below the finished exterior grade or the floor slab, as appropriate.

- **Soil/Concrete Sliding Friction**

For horizontal loads, we recommend a soil-concrete friction factor of 0.35. The frictional factor should be applied only to the base (bottom) of the concrete foundation units and only the net

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downward vertical load should be used to determine the friction. An appropriate safety factor should be applied to the calculated lateral values.

2.4 Exterior Backfill

- **Soil Type**

As previously noted, fat clay soils exist at the site which can cause structural distress with a change in moisture content. Therefore, to help limit moisture changes of the fat clay, we recommend that the exterior backfill soils (fill soils placed outside the exterior foundations walls and adjacent areas) consist of only clay soils. Assuming the absence of retaining or below grade basement walls, the on-site fat clay (CH) or lean clay (CL) could be used for exterior backfill soils. The clay backfill soils should have a plasticity index of at least 16. Sandy or other highly permeable soils (sand, silt, etc.) should not be used for exterior backfill.

Organic soils (usually black colored) should not be used for exterior backfill, except for cover material. Also, soils that can expand, such as fat clay (CH), should not be used for backfill against retaining type structures or below slabs/sidewalks. Utility trenches or other excavations leading to the building foundations or floor areas should be backfilled with the on-site or imported non-organic clay soils. If the on-site clay soils are used, the moisture content of some may have to be adjusted to near the optimum moisture content (as per ASTM: D698) prior to placement in order to achieve the specified density.

- **Compaction and Placement of Exterior Backfill**

Exterior backfill soils placed along foundation walls and in adjacent areas such as beneath lawns, sidewalks, traffic areas, or in utility line trenches, should be compacted to the following minimum densities as listed in Table 2 below. Note: Exterior backfill soils placed within the "influence zone" below the footings should be compacted to the minimum densities listed for foundations on page 8.

TABLE 2

Compaction of Exterior Backfill	Light Traffic Areas (autos, driveways, sidewalks, etc. - below granular base):	95% of the ASTM: D698*
	Heavy Truck Traffic Areas (below granular base):	97% of the ASTM: D698*
	Utility lines and other backfill within 10 feet of the proposed structure(s)	95% of the ASTM: D698*
	Non-Traffic Areas (lawns, landscaping areas, etc.) greater than 10 feet of the proposed structure(s)	92% of the ASTM: D698*

*Standard Proctor Density

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Exterior backfill soils should be compacted in maximum 12-inch loose lifts using heavy, self-propelled compaction equipment, or maximum 6-inch loose lifts using hand-operated compaction equipment. Clay exterior backfill soils should be placed at a moisture content ranging from -4% to +2% of the optimum moisture content as determined by the Standard Proctor. The backfill material should be free of frost and should not be placed on frozen soils. Please refer to the "Precautions...During Cold Weather" attached to this report.

2.5 Site Drainage

- **Site Grading**

Proper drainage should be maintained during and after construction. General site grading should not allow water to pond in the building area or in the excavations. Any ponded water should be removed immediately. Finished grades around the perimeter of the structure should be sloped away from the structure with a minimum slope of 1 inch per foot for at least 15 feet beyond the excavation lines. (Please refer to Figure #5 below.) The slope can be reduced to ¼ inch per foot in areas that are completely surfaced and properly sealed with asphalt or concrete. The slope and proper drainage should be maintained throughout the life of the structure.

Exterior Backfill and Site Drainage

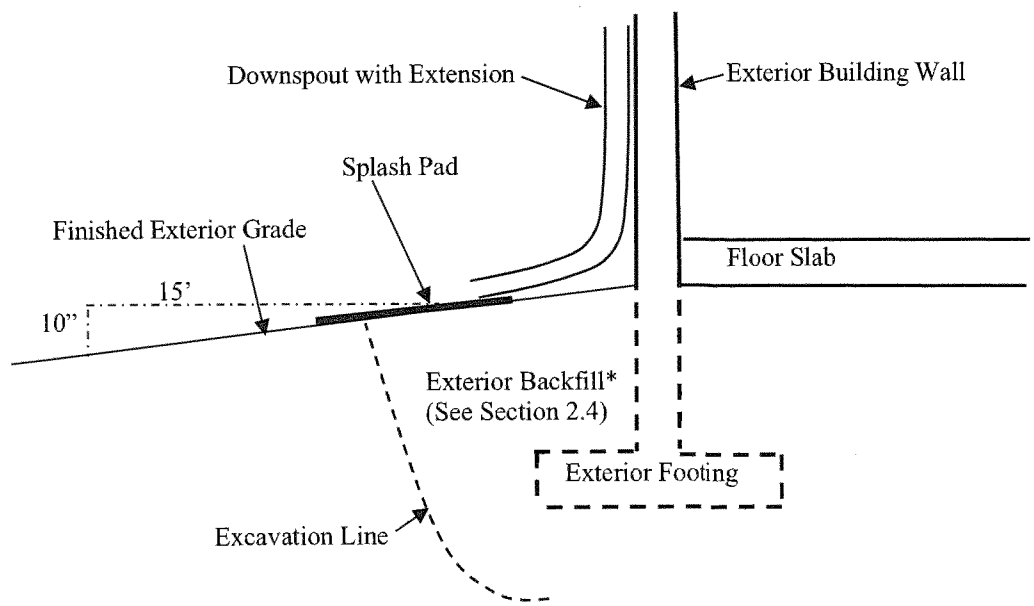

Figure #5 (not a plan drawing) *Specific specifications listed in this report.

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- **Roof Runoff**

Roof runoff water should be controlled by a system of downspouts and gutters with proper extensions to remove the runoff water away from the structure. The gutters and downspouts, as well as splash pads and extensions, should be maintained so that leakage does not occur adjacent to the structure. (Please refer to Figure #5 above.)

- **Subgrade and Surface Drainage**

We recommend that extra care be taken in the design and construction process to ensure that pavement or other hard surfaces be uniformly sloped to facilitate drainage away from the proposed building. If appropriate, edge drains and storm sewer drains should be incorporated into the pavement design where possible. Timely maintenance such as crack filling, seal coats, and localized patching should be routinely performed to maintain drainage away from the building.

- **Exterior Plantings & Watering**

Due to the presence of the fat clay at the site and its potential to cause structural distress, we recommend that trees and shrubs which have a high-water demand not be placed adjacent to the proposed structure. Trees should be planted no closer to the structure than the anticipated mature height. Also, excessive watering to the exterior plants should be prohibited. If foundation plantings are desired, self-contained planters should be utilized. If the lawn within 15 feet of the building is watered, sprinkling should be done sparingly, and the water should not be allowed to spray directly on the structure.

3.0 CONSTRUCTION AND DESIGN CONSIDERATIONS

3.1 Site Excavation

- **Soil Disturbance & Moisture Changes**

The soils encountered at the site can be sensitive to disturbance and will experience strength loss under the influence of construction traffic and/or additional moisture. Construction traffic in areas where these soils are used for structural support should be limited. If self-propelled compaction equipment is used, extra care should be taken so as not to disturb (weaken) the native soils, especially if the compaction equipment is used in a vibratory mode. Disturbance or saturation of the soils will require additional excavation and backfilling. Also, the excavations should be done with an excavation bucket having a smooth cutting edge. The excavations should be left open a minimal amount of time to prevent strength loss of these soils by ponding of water or

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changes in their in-situ moisture content. In addition, surface drainage away from the excavations should be provided during construction.

- **Dewatering**

We do not anticipate that the excavations will extend below the groundwater level, and thus, dewatering techniques for proper placement of engineered fill and/or the footings/floor slab system are not anticipated, but it should not be ruled out. Please refer to the groundwater measurements listed at the bottom of the attached boring logs.

NOTE: If the excavations do extend below the groundwater level and immediate placement and compaction of the first 2-3 feet of engineered fill can be performed, dewatering may not be necessary. Alternatively, if the engineered fill cannot be immediately placed and compacted, dewatering the excavations (lowering the ground water level within and below the bottom of the excavation) should be provided during the excavations, and the excavations should remain dewatered until placement of the engineered fill, foundations, and lower portions of the exterior backfill are completed. Dewatering will also help limit the potential softening or loosening of the native clay soils prior to placement of the engineered fill and footings.

- **Seismic Category**

Based on IBC 2018, the subsurface conditions encountered at the site, and our experience with other general geologic conditions for this area, it is our opinion that Site Class D should be used to determine site coefficients and seismic design category.

- **Expansion Joint and Structural Movement Considerations**

We recommend the placement of an expansion joint between the existing structure and the proposed addition or its corridors to accommodate any differential movement that may occur.

- **Existing Structure**

If the foundations for the proposed building are placed next to an existing structure, care should be taken not to undermine the foundations of the existing structure. Also, to prevent additional loading on the existing foundations, the new foundations should rest at or below the depth of the existing foundations. If the new foundations rest within a 45^0 envelope below the existing foundations, the new foundations may need to be designed for increased loading caused by the overlying pressures of the existing footings. Please contact us if this situation develops in the design.

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- **Exterior Movement**

Exterior architectural features, slabs, and utilities can experience moisture or frost related movement which can result in distress. The risk of this potential movement and subsequent distress can be reduced (but not necessarily eliminated) by:

1. The use of control joints.
2. The use of self-adjusting utility connections.
3. Allowing for movement for exterior features attached to structural elements.
4. The use of significant depths of granular fill material beneath slabs-on-grade.
5. Proper drainage away from exterior slabs-on-grade.
6. Placement of rigid insulation sheeting under at least 10 inches of free draining granular fill.

- **OSHA**

Excavations must comply with the requirements of local, state, federal and other prescribed safety regulations, e.g., OSHA 29 CFR Part 1926, Subpart P, "Excavations." Reference to these requirements should be included in the project specifications.

3.2 Excavation Observation and Testing

The recommendations contained in this report are based on the subsurface conditions found at the boring locations. It is possible that there are soil conditions on the site that were not represented by the borings. Consequently, on-site observation by a qualified Geotechnical Engineer during construction is considered integral to the successful implementation of the recommendations.

We recommend that a Geotechnical Engineer from Soil Technologies, Inc. be on-site during the excavation operations. The engineer will judge if the soils exposed at the bottom and along the sidewalls of the excavations are adequate for support of the floor slab and for the foundations designed with the allowable soil bearing pressure recommended in this report. The engineer will also judge if the site preparation recommendations of this report have been implemented during construction. In addition, we recommend that density testing be performed within the sequence of the engineered fill.

3.3 Concrete

The concrete should be composed of a quality mix that has proven success, or a mix design should be established for proper proportions of aggregate, cement, water, and any admixtures. The concrete should be handled, placed, and cured according to the recommendations in the current

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ACI manual. Improper mix designs, placement methods, saw joints, curing methods, temperatures, etc. could result in the concrete experiencing excessive shrinkage, cracking, curling, pop-outs, and other distress. These items should be monitored by a qualified engineer during construction. Also, floor covering should not be placed on the slab until it is near fully cured. Typically, flooring manufactures require 3 to 4 weeks or more of curing time at room temperature (60° F or more) prior to placement of flooring.

3.4 Movement of Building Components

Due to the potential movement of the fat clay soils, we recommend that the floor slabs be isolated from other building components. The isolation should include installation of an expansion joint between the floor and other building components. A sealant should be applied to the expansion joint to minimize moisture penetration through it. Also, bond breakers should be installed to reduce binding between the building components.

4.0 GENERAL EXPLORATION INFORMATION

4.1 Scope of Exploration

We have conducted a soil exploration program for the proposed project. The scope of our services under this exploration is limited to the following:

1. To perform soil borings to explore the subsurface soil and groundwater conditions.
2. To perform nominal laboratory tests to aid in judging the soil properties.
3. To provide a geotechnical engineering report including the results of the field and laboratory tests as well as geotechnical engineering opinions and recommendations that are relative to the project.

Six standard penetration test borings were performed at the site on October 4, 2021. The borings were performed at the locations shown on the attached sketch. Some settlement of the soils used to fill the open bore holes should be anticipated and closure of the holes is the responsibility of the client or property owner.

4.2 Site Surface Conditions

The site of the proposed construction is located between the Vo-tech building and Education building of SW College, about 7 miles south of Sisseton, SD. The site is bordered on the west by 457th Avenue. The site surface at the time of our soil borings consisted of mostly grass.

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The overall general topography of the site is relatively level. The ground elevations at the boring locations were referenced to the survey benchmark (BM) shown on the attached sketch. The elevations are listed at the top of the attached boring logs.

4.3 Site Subsurface Conditions

The subsurface conditions encountered at each boring location are illustrated on logs attached to this report. The logs also indicate the possible geologic origin of the materials encountered. A description of the general soil profile is also provided in section **2.1 Discussion.** We wish to point out that the subsurface conditions at other times and locations at this site may differ from those found at our boring locations. If different subsurface conditions are encountered during construction, it is necessary that you contact us so that our recommendations can be reviewed.

4.4 Water Levels

Observations for subsurface groundwater were made at the boring locations during our field operations. Groundwater was encountered at the boring locations during our sampling operations. Specific information relative to the groundwater observations is shown at the bottom of the boring logs.

Please note that in order to accurately determine the static groundwater level, observations over a long period are usually required. Such periods of observation are normally not available in a typical soil exploration program. Seasonal and annual fluctuations of the groundwater levels should be expected to occur. It is possible that the subsurface groundwater levels during or after construction could be significantly different than at the time the borings were performed.

4.5 Laboratory Test Program

Soil samples were selected for laboratory tests to determine the engineering and index properties. Where applicable, the tests were performed in accordance with the American Society for Testing and Materials (ASTM) procedures. The test results are shown on the test hole boring logs opposite the samples upon which the tests were made or, they are attached.

5.0 LIMITATIONS, REVIEW, USE, AND PURPOSE OF REPORT

- **Limitations**

The data obtained from the sampling and testing of the soils encountered at the boring locations

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are the basis of the recommendations submitted in this report. However, variations can occur between these borings and between the samples. Thus, no exploration program can totally reveal the exact subsurface conditions for the entire site. If the subsurface conditions encountered at the time of construction differ from those represented by our borings, it is necessary to contact us so that our opinions and recommendations can be reviewed. Differing subsurface conditions may result in altering our recommendations which may affect construction costs. It is suggested that a contingency be provided for this purpose.

- **Review of Report**

This report is founded on the information and conditions listed in this report for design of the proposed structure(s). We recommend that we be retained to briefly review the geotechnical aspects of the final design and specifications to determine whether any changes in design may have had an effect on the validity of the recommendations contained in this report, and whether our recommendations have been correctly communicated so that their intent has been implemented in the design and specifications. Divergence from our recommendations by the design, specifications, or field applications shall relieve us of the responsibility of that portion of the project and its effect on related components unless our written agreement with such divergence has been obtained. Also, we recommend that this report is provided to the owner(s) along with the architects, engineers, contractors, etc. chosen for design and construction of the project.

- **Use of Report**

This report is intended for the Client's sole use and benefit and solely for the Client's use in design and construction of the proposed project described herein and preparation of construction documents. The data, analysis, and recommendations in this report may not be appropriate for extensions of the proposed project or for other project or purposes. Thus, this report shall not be used or relied on by persons or entities for extensions of the proposed project or for other projects or purposes. Parties contemplating extensions of the proposed project or for other projects or purposes must contact us for additional review. In the absence of our written review and approval, we make no representation and assume no responsibility for extensions of the proposed project or for other projects or purposes. Also, this report is not a bidding document and is only an aid in design and construction of the proposed project. Contractors and others involved in the project must draw their own conclusions regarding the site conditions and construction methods.

- **Purpose of Report**

The purpose of this report is to present the results of our field and laboratory tests as well as our geotechnical engineering review and recommendations for the project. Our work is intended for

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geotechnical purposes only and not to verify the presence or extent of any contamination at the site. If environmental information is desired, an environmental assessment should be conducted.

6.0 STANDARD OF CARE

The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted engineering procedures at this time and location. Other than this, no other representation, guarantee, or warranty, either expressed or implied, is made.

This report was prepared by:

Kim E. Stoecker, PE
President

REGISTERED PROFESSIONAL ENGINEER
REG. NO 6394
KIM E. STOECKER
SOUTH DAKOTA

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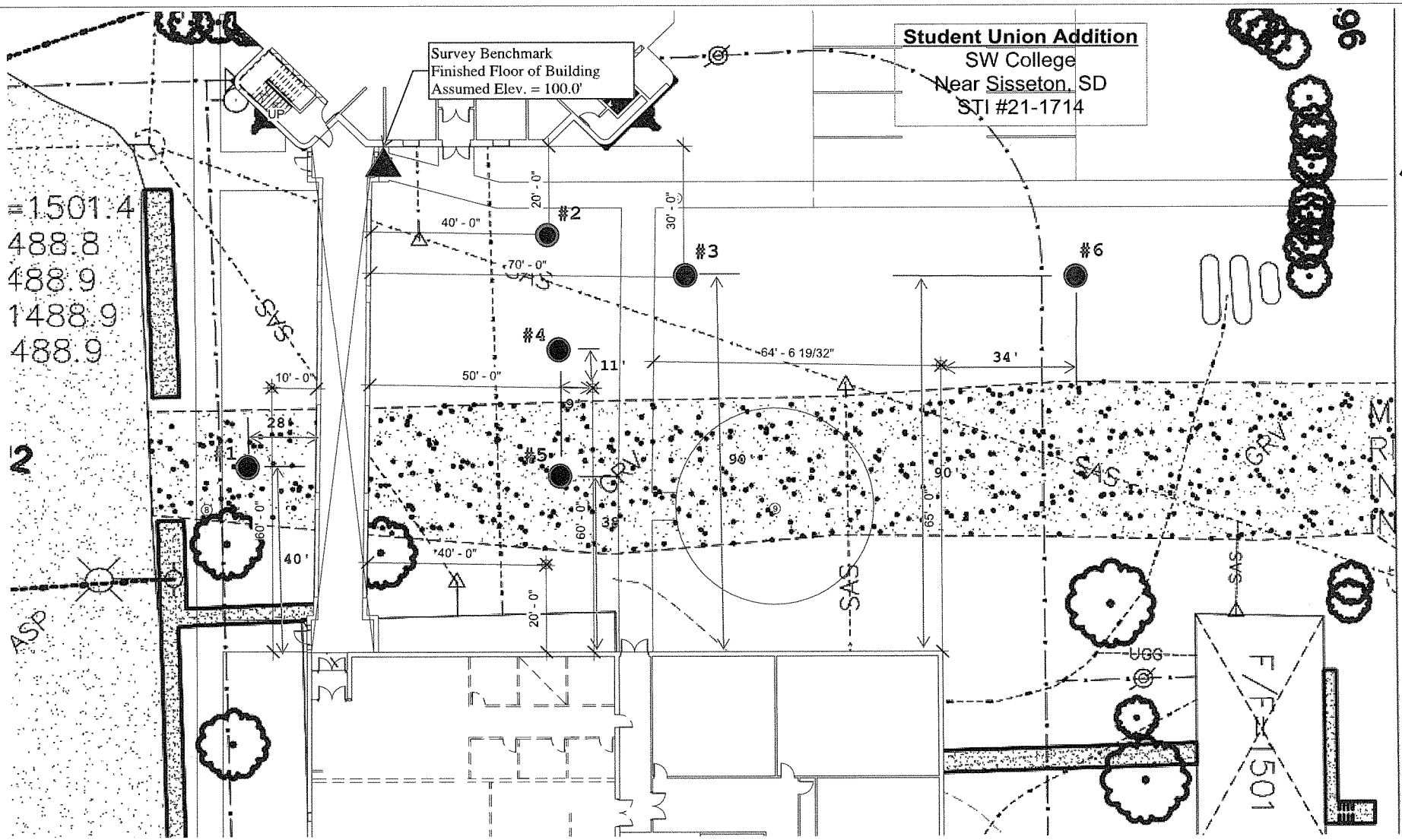


● = Boring Locations

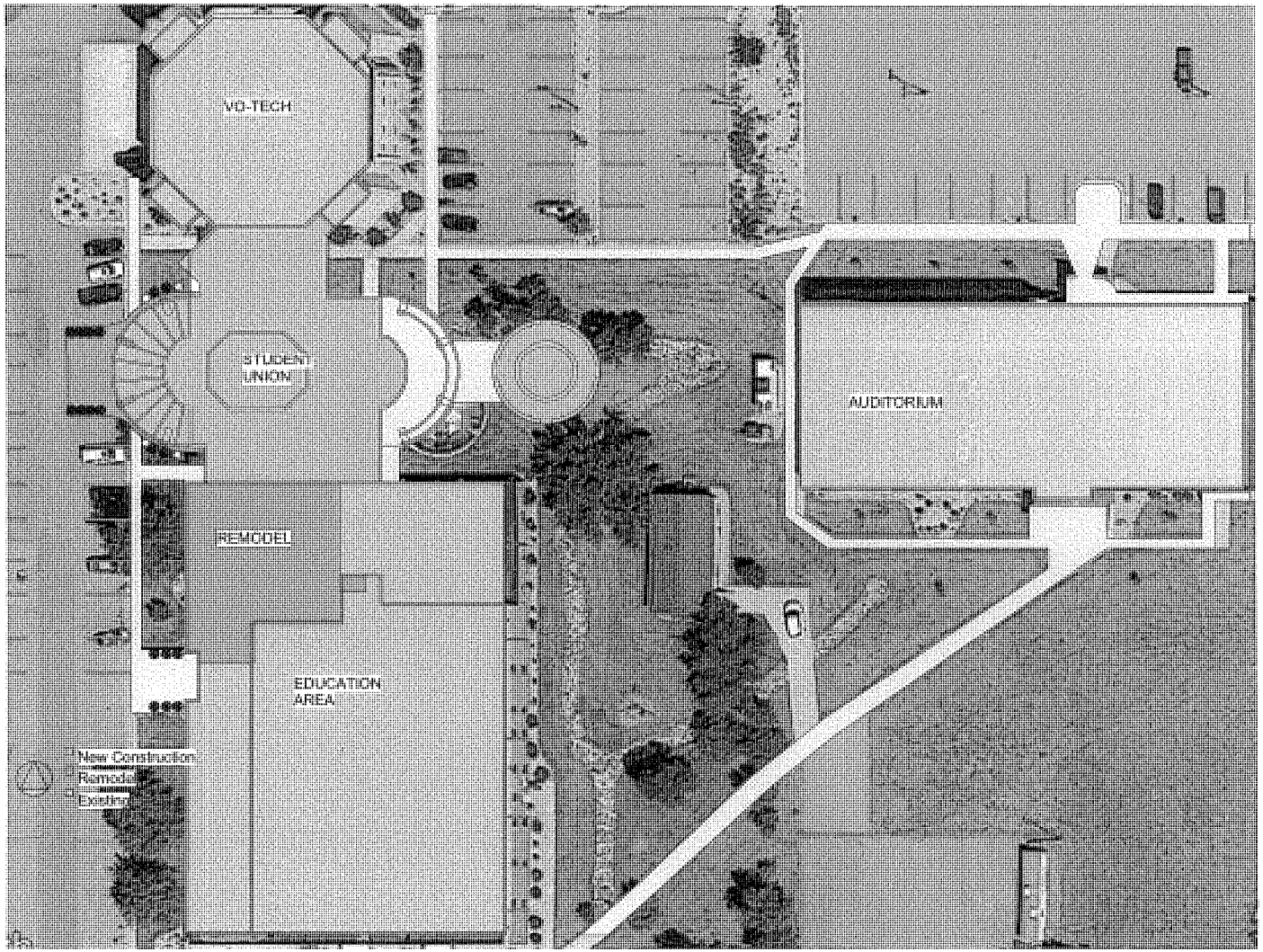
Boring Locations Determined by HKG

① Level 1
3/64" = 1'-0"

hkg architects

Plans for SW Student Union Songs to the Spirit Community College Sisseton, SOUTH DAKOTA	Soil Boring Locations	DRAWN BY	
		CHECKED BY	OF
HKG Architects, Inc. Aberdeen, S.D.		DATE 10/4/21	PROJECT NO ?

Student Union Addition
SW College
Near Sisseton, SD
STI #21-1714



1 Site
1" = 50'-0"

hkg architects

Plans for
SW STUDENT UNION
SONGS TO THE SPIRIT
COMMUNITY COLLEGE
SISSETON, SOUTH DAKOTA

Proposed Site Plan

HKG Architects, Inc. Aberdeen, S.D.

DATE 9/7/21

OF-

PROJECT NO. ?

BORING LOG

STI JOB #: 21-1714 **Project:** Proposed Student Union Addition **BORING #:** 1
Location: SW College - Sisseton SD Sheet 1 of 2

Latitude (North)= Longitude (West)= **SURFACE ELEVATION =** 100.3

Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE Sample No.	SAMPLE Sample Type	LABORATORY TESTS Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
1	99.3	**Fill**, Organic Lean Clay, black, moist	FILL		7	1	SPT							
2	98.3	**Fill**, Lean Clay with Gravel, brown and black, moist												
		Lean Clay, some Organics, dark brown, moist, stiff (CL/CH)	FINE ALLUVIUM	▼	14	2	SPT							
4.3	96.0	**Fat Clay**, a little Gravel, dark brown mottled and gray, moist, firm (CH)	TILL		8	3	SPT							
					7	4	SPT	26	95	1.2		57	24	
9	91.3	**Fat Clay**, a little Gravel, brown mottled, moist, stiff (CH)			12	5	SPT							
11.5	88.8	**Fat Clay with Sand**, a little Gravel, brown, moist, a lamination of waterbearing Sand at 20', stiff to very stiff (CH)			14	6	SPT							
					12	7	SPT							
					18	8	SPT							

For Footings and Floors: Excavate the "Fill" soils to expose the native Clay "Alluvium" soils at a depth of at least 2.0' below the existing grade. In addition, extend the footing and floor excavations to the depth required to place at least 3 feet of engineered fill below the footings and at least 4 feet of engineered fill below the floor slab. Final excavation depth shall be determined on-site by STI's Geotechnical Engineer.

WATER LEVEL MEASUREMENTS ▼

DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:
10/4/2021	11:40	21'	none	19.5'	20'
10/4/2021	12:10		30'	none	24'
10/4/2021	17:38		24'	none	4'

Boring Started: 10/4/2021 *at* 10:57
Boring Completed: 10/4/2021 *at* 12:04
Drilling Method: *to*
Drilling Method: 3 1/4" HSA 0' *to* 29.5'
Jet with Drilling Mud: *to*
Hammer Type: Auto Hammer (140 lb)
Crew Chief: BO **Logged By:** BO
Backfill Method:

SOIL TECHNOLOGIES, INC
28822 124TH ST., MOBRIDGE, SD
TELEPHONE: (605) 762-3406

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BORING LOG

STI JOB #: 21-1714 **Project:** Proposed Student Union Addition **BORING #:** 1
Location: SW College - Sisseton SD Sheet 2 of 2

Latitude (North)= Longitude (West)= **SURFACE ELEVATION =** 100.3

Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE Sample No.	SAMPLE Sample Type	LABORATORY TESTS Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
		(Continued from Sheet 1)												
					24	9	SPT	22	108	2.1				
					18	10	SPT							
31	69.3	END OF BORING												

WATER LEVEL MEASUREMENTS

DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:
(SEE SHEET ONE)					

Boring Started: at
Boring Completed: at
Drilling Method: to
Drilling Method: to
Jet with Drilling Mud: to
Hammer Type: Auto Hammer (140 lb)
Crew Chief: BO **Logged By:** BO
Backfill Method:

SOIL TECHNOLOGIES, INC
28822 124TH ST., MOBRIDGE, SD
TELEPHONE: (605) 762-3406

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BORING LOG

STI JOB #: 21-1714 **Project:** Proposed Student Union Addition **BORING #:** 2
Location: SW College - Sisseton SD Sheet 1 of 2

Latitude (North)= Longitude (West)= **SURFACE ELEVATION =** 100.0

Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE No.	SAMPLE Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
0.8	99.2	**Fill**, Organic Lean Clay, black, moist	FILL		8	1	SPT							
		Fill, Lean Clay, a little Gravel, brown and dark brown and black, moist			8	2	SPT							
4.3	95.7	**Lean Clay**, a little Gravel, brown, moist, firm (CL/CH)	TILL		8	3	SPT							
6.5	93.5	**Fat Clay**, a little Gravel, dark brown mottled and gray, moist, stiff (CH)			12	4	SPT							
					10	5	SPT	26	96	2.9				
11.5	88.5	**Fat Clay**, a little Gravel, brown mottled, moist, stiff (CH)			12	6	SPT							
14	86.0	**Fat Clay**, a little Gravel, brown, moist, stiff (CH)		▼	12	7	SPT							
18	82.0	**Fat Clay with Sand**, brown mottled, moist, stiff to very stiff (CH)			14	8	SPT	20	109	2.4				

For Footings and Floors: Excavate the "Fill" soils to expose native Clay "Till" soils at a depth of at least 4.3' below the existing grade. In addition, extend the footing and floor excavations to the depth required to place at least 3 feet of engineered fill below the footings and at least 4 feet of engineered fill below the floor slab. Final excavation depth shall be determined on-site by STI's Geotechnical Engineer.

WATER LEVEL MEASUREMENTS ▼

DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:
10/4/2021	13:56		30'	none	19'
10/4/2021	17:06		26'	none	15.5'

Boring Started: 10/4/2021 at 12:28
Boring Completed: 10/4/2021 at 13:48
Drilling Method: to
Drilling Method: 3 1/4" HSA 0' to 29.5'
Jet with Drilling Mud: to
Hammer Type: Auto Hammer (140 lb)
Crew Chief: BO **Logged By:** BO
Backfill Method:

SOIL TECHNOLOGIES, INC
28822 124TH ST., MOBRIDGE, SD
TELEPHONE: (605) 762-3406

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BORING LOG

STI JOB #: 21-1714 **Project:** Proposed Student Union Addition **BORING #:** 2
Location: SW College - Sisseton SD Sheet 2 of 2

Latitude (North)= Longitude (West)= **SURFACE ELEVATION =** 100.0

Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE Sample No.	SAMPLE Sample Type	LABORATORY TESTS Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
		(Continued from Sheet 1)												
					19	9	SPT							
					18	10	SPT							
31	69.0	END OF BORING												

WATER LEVEL MEASUREMENTS

DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:
(SEE SHEET ONE)					

Boring Started: at
Boring Completed: at
Drilling Method: to
Drilling Method: to
Jet with Drilling Mud: to
Hammer Type: Auto Hammer (140 lb)
Crew Chief: BO **Logged By:** BO
Backfill Method:

SOIL TECHNOLOGIES, INC
28822 124TH ST., MOBRIDGE, SD
TELEPHONE: (605) 762-3406

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BORING LOG

STI JOB #: 21-1714 **Project:** Proposed Student Union Addition **BORING #:** 3
Location: SW College - Sisseton SD Sheet 1 of 1

Latitude (North)= Longitude (West)= **SURFACE ELEVATION =** 99.7

Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE Sample No.	SAMPLE Sample Type	LABORATORY TESTS Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
1	98.7	**Fill**, Organic Lean Clay, black, moist	FILL		6	1	SPT							
2	97.7	**Fill**, Lean Clay, brown and black, moist												
3	96.7	**Lean Clay**, a little Gravel, brown, moist, stiff (CL)	TILL		15	2	SPT							
4.3	95.4	**Fat Clay**, brown and black, moist (CH)												
		Fat Clay, a little Gravel, brown mottled and gray, moist, firm to stiff (CH)			8	3	SPT							
					10	4	SPT	24	103	2.4		50	21	
					13	5	SPT							
					11	6	SPT							
					12	7	SPT							
16	83.7	END OF BORING												

For Footings and Floors: Excavate the "Fill" soils to expose native Clay "Till" soils at a depth of at least 2.0' below the existing grade. In addition, extend the footing and floor excavations to the depth required to place at least 3 feet of engineered fill below the footings and at least 4 feet of engineered fill below the floor slab. Final excavation depth shall be determined on-site by STI's Geotechnical Engineer.

WATER LEVEL MEASUREMENTS

DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:
10/4/2021	16:25		16'	none	none

Boring Started: 10/4/2021 *at* 15:57
Boring Completed: 10/4/2021 *at* 16:23
Drilling Method: *to*
Drilling Method: 3 1/4" HSA 0' *to* 4'
Jet with Drilling Mud: *to*
Hammer Type: Auto Hammer (140 lb)
Crew Chief: BO **Logged By:** BO
Backfill Method:

SOIL TECHNOLOGIES, INC
28822 124TH ST., MOBRIDGE, SD
TELEPHONE: (605) 762-3406

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BORING LOG

STI JOB #: 21-1714 **Project:** Proposed Student Union Addition **BORING #:** 4
Location: SW College - Sisseton SD Sheet 1 of 1

Latitude (North)= Longitude (West)= **SURFACE ELEVATION =** 99.3

Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE: Sample No.	SAMPLE: Sample Type	LABORATORY TESTS: Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
1	98.3	**Fill**, Organic Lean Clay, black, moist	FILL		5	1	SPT							
		Fill, Fat Clay, brown and black, moist												
2	97.3	**Organic Lean Clay**, black, moist (CL/CH)	TOPSOIL		11	2	SPT							
3.5	95.8	**Lean Clay**, a little Gravel, brown mottled and gray, moist, stiff (CL/CH)	TILL		10	3	SPT							
6.5	92.8	**Fat Clay**, a little Gravel, brown mottled, moist, stiff (CH)			9	4	SPT	27	96	1.6				
9	90.3	**Fat Clay**, a little Gravel, brown mottled and dark gray, moist, stiff (CH)			11	5	SPT							
11.5	87.8	**Fat Clay**, a little Gravel, brown, moist, stiff (CH)			12	6	SPT							
16	83.3	END OF BORING			10	7	SPT	22	105	1.7				

For Footings and Floors: Excavate the "Fill" soils and "Topsoil" to expose native Clay "Till" soils at a depth of at least 3.5' below the existing grade. In addition, extend the footing and floor excavations to the depth required to place at least 3 feet of engineered fill below the footings and at least 4 feet of engineered fill below the floor slab. Final excavation depth shall be determined on-site by STI's Geotechnical Engineer.

WATER LEVEL MEASUREMENTS

DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:
10/4/2021	15:50		16'	none	none

Boring Started: 10/4/2021 *at* 15:22
Boring Completed: 10/4/2021 *at* 15:48
Drilling Method: *to*
Drilling Method: 3 1/4" HSA 0' *to* 4'
Jet with Drilling Mud: *to*
Hammer Type: Auto Hammer (140 lb)
Crew Chief: BO **Logged By:** BO
Backfill Method:

SOIL TECHNOLOGIES, INC
28822 124TH ST., MOBRIDGE, SD
TELEPHONE: (605) 762-3406

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BORING LOG

STI JOB #: 21-1714 **Project:** Proposed Student Union Addition **BORING #:** 5
Location: SW College - Sisseton SD Sheet 1 of 2

Latitude (North)= Longitude (West)= **SURFACE ELEVATION =** 99.4

Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE No.	SAMPLE Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
1	98.4	**Fill**, Organic Lean Clay, black, moist	FILL		6	1	SPT							
2	97.4	**Fill**, Lean Clay, a little Gravel, brown and black, moist												
3	96.4	**Organic Lean Clay**, dark brown, moist (CL/CH)	TOPSOIL		15	2	SPT							
4.3	95.1	**Lean Clay**, brown, moist (CL)	FINE ALLUVIUM											
		Fat Clay, a little Gravel, brown mottled and gray, moist, stiff to firm (CH)	TILL		11	3	SPT							
					8	4	SPT	33	85	1.7				
9	90.4	**Fat Clay**, a little Gravel, brown mottled, a lamination of Sand at 15', moist, stiff (CH)			11	5	SPT							
					12	6	SPT							
				▼	12	7	SPT							
					15	8	SPT							

For Footings and Floors: Excavate the "Fill" soils and "Topsoil" to expose native Clay "Alluvium" soils at a depth of at least 3.0' below the existing grade. In addition, extend the footing and floor excavations to the depth required to place at least 3 feet of engineered fill below the footings and at least 4 feet of engineered fill below the floor slab. Final excavation depth shall be determined on-site by STI's Geotechnical Engineer.

WATER LEVEL MEASUREMENTS

DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:
10/4/2021	14:38	16'	16'	14.5'	15'
10/4/2021	15:11		30.5"	none	15'

Boring Started: 10/4/2021 *at* 14:07
Boring Completed: 10/4/2021 *at* 15:04
Drilling Method: *to*
Drilling Method: 3 1/4" HSA 0' *to* 29.5'
Jet with Drilling Mud: *to*
Hammer Type: Auto Hammer (140 lb)
Crew Chief: BO **Logged By:** BO
Backfill Method:

SOIL TECHNOLOGIES, INC
28822 124TH ST., MOBRIDGE, SD
TELEPHONE: (605) 762-3406

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BORING LOG

STI JOB #: 21-1714 **Project:** Proposed Student Union Addition **BORING #:** 5
Location: SW College - Sisseton SD Sheet 2 of 2

Latitude (North)= Longitude (West)= **SURFACE ELEVATION =** 99.4

Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE Sample No.	SAMPLE Sample Type	LABORATORY TESTS Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
		(Continued from Sheet 1)												
					13	9	SPT	22	108	1.6				
					15	10	SPT							
31	68.4	END OF BORING												

WATER LEVEL MEASUREMENTS

DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:
(SEE SHEET ONE)					

Boring Started: at
Boring Completed: at
Drilling Method: to
Drilling Method: to
Jet with Drilling Mud: to
Hammer Type: Auto Hammer (140 lb)
Crew Chief: BO **Logged By:** BO
Backfill Method:

SOIL TECHNOLOGIES, INC
28822 124TH ST., MOBRIDGE, SD
TELEPHONE: (605) 762-3406

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BORING LOG

STI JOB #: 21-1714 **Project:** Proposed Student Union Addition **BORING #:** 6
Location: SW College - Sisseton SD Sheet 1 of 1

Latitude (North)= Longitude (West)= **SURFACE ELEVATION =** 97.9

Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
		Fill, Organic Lean Clay, black, moist, Cobbles	FILL		8	1	SPT							
2	95.9	**Organic Lean Clay**, black, moist (CL)	TOPSOIL		11	2	SPT							
4.3	93.6	**Fat Clay**, a little Gravel, brown mottled and gray, moist, laminations of Sand, stiff to firm (CH)	TILL		10	3	SPT							
					8	4	SPT							
					8	5	SPT	25	100	1.5				
11.5	86.4	**Fat Clay**, a little Gravel, brown mottled, moist, stiff (CH)			11	6	SPT							
					12	7	SPT							
16	81.9	END OF BORING												

For Footings and Floors: Excavate the"Fill" soils and "Topsoil" to expose native Clay "Till" soils at a depth of at least 4.3' below the existing grade. In addition, extend the footing and floor excavations to the depth required to place at least 3 feet of engineered fill below the footings and at least 4 feet of engineered fill below the floor slab. Final excavation depth shall be determined on-site by STI's Geotechnical Engineer.

WATER LEVEL MEASUREMENTS

DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:
10/4/2021	17:04		15.5'	none	none

Boring Started: 10/4/2021 *at* 16:31
Boring Completed: 10/4/2021 *at* 17:00
Drilling Method: *to*
Drilling Method: 3 1/4" HSA 0' *to* 4'
Jet with Drilling Mud: *to*
Hammer Type: Auto Hammer (140 lb)
Crew Chief: BO **Logged By:** BO
Backfill Method:

SOIL TECHNOLOGIES, INC
28822 124TH ST., MOBRIDGE, SD
TELEPHONE: (605) 762-3406

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FIELD EXPLORATION PROCEDURES

Soil Sampling

Soil sampling was performed in accordance with ASTM: D1586. Using this procedure, a 2" O.D. split barrel sampler is driven into the soil by a 140-lb. weight (hammer) falling 30". After an initial set of 6", the number of blows required to drive the sampler an additional 12" is known as the penetration resistance or N value. The N value is an index of the relative density of the cohesionless (sandy) soils and the consistency of cohesive (clayey) soils. Thin walled tube samples, if taken, were obtained according the ASTM: D1587 where indicated by the appropriate symbol on the boring logs. Rock core samples, if taken, were obtained by rotary drilling in accordance with ASTM: D2113. Power auger borings, if performed, were done in general accordance with ASTM: D1452.

Soil Classification

As the samples were obtained in the field, they were visually and manually classified by the crew chief in general accordance with ASTM: D2487. Representative portions of the samples were then returned to the laboratory for further examination and for verification of the field classification. Logs of the borings (test holes) indicating the depth and identification of the various strata, the N value, water level information and pertinent information regarding the method of maintaining and advancing the bore holes are attached. Charts illustrating the descriptive terminology and the symbols used on the boring logs are also attached.

LOG OF BORING– "DESCRIPTIONS"

Depth - Depth below the existing grade at the location and time the sampling was performed.
Description of Material – Soil type based on visual and manual methods and/or laboratory tests (see "Soil Classification" above).
Surface Elevation – Elevation of the existing grade at the boring location and at the time the boring was performed.
Geologic Origin - A description of the most likely source of the soil deposit.
WL - The highest groundwater measurement at the time and location the sampling was performed marked by the symbol ▼. (Also see "Water Level Measurements" on boring log).
N VALUE - The number of hammer blows required to drive the sampler 12" (see "Soil Sampling" above).
SAMPLE NO. – The sample number, i.e. 1, 2, 3….
SAMPLE TYPE – The type of equipment used to sample the soil (SPT = Standard Penetration Test, SB = Split Barrel Sampler, FA = Flight Auger, HSA = Hollow Stem Auger).
QU – Laboratory test. (See the attached "Symbols and Terminology.")
Drilling Method – The type of equipment used in to advance (drill) the boring.

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SYMBOLS AND TERMINOLOGY

DRILLLING AND SAMPLING SYMBOLS

SYMBOL	DEFINITION
N	Standard Penetration – blows per foot
WOH	Weight of Hammer
B	Bag Sample
DM	Drilling Mud
FA	Flight Auger
HA	Hand Auger
HSA	Hollow Stem Auger
JW	Jetting Water
NSR	No Sample Recovered
_Q	BQ, NQ or PQ Wireline System
SB	Split Barrel Sampler
SPT	Standard Penetration Test
3TW	3" Thin Walled Tube Sample
CS	California Sampler
▼	Water Level Symbol

TEST SYBMOLS

SYMBOL	DEFINITION
W	Water Content by weight (ASTM:D2216)
D	Dry Density - pounds per cubic foot
LL	Liquid Limit (ASTM: D4318)
PL	Plastic Limit (ASTM: D438)
Qu	Unconfined Compressive Strength – pounds per square foot (ASTM: D2166)
Pq	Penetrometer Reading – tons/square ft.
Su	Undrained Shear Strength
R	Laboratory Resistivity
G	Specific Gravity – ASTM: D854
OC	Organic Content
K	Coefficient of Permeability
VS	Field Vane Shear (ASTM: D2573)
RQD	Rock Quality Designation - percent
CR	Core Recovery (percent)

WATER LEVELS

Water levels shown on the test hole (boring) logs are the water levels measured in the test holes at the time and under the conditions indicated. In sand soil, the indicated levels may be considered fairly reliable ground water levels. In clay soil, it may not be possible to determine the ground water level within the normal time required for the test hole, except where lenses or layers of more pervious waterbearing soil are present. Even then, an extended period of time may be necessary to reach equilibrium. Therefore, the water levels shown on the test hole logs for cohesive or mixed texture soils may not indicate the true level of the ground water table. Perched water refers to water above an impervious layer, thus impeded in reaching the water table. The available water level information is given at the bottom of the log sheet.

DESCRIPTIVE TERMINOLOGY

RELATIVE DENSITY	"N" VALUE
very loose	0-4
loose	5-10
medium dense	11-24
dense	25-50
very dense	>50

CONSISTENCY	"N" VALUE
very soft	0-1
soft	2-4
firm	5-8
stiff	9-15
very stiff	16-30
hard	31-60
very hard	>60

"N" is the Standard Penetration, in blows per foot, of a 140 pound hammer falling 30 inches onto a 2 inch OD split barrel sampler.

Lamination	Up to ½" thick stratum
Layer	½" to 6"
Lens	½" to 6" discontinuous stratum, pocket
Varved	Alternating laminations of clay, silt and /or fine grained sand, or colors thereof
Dry	Powdery, no noticeable water
Moist	Below saturation
Wet	Saturated, above liquid limit
Waterbearing	Pervious - soil is below water

RELATIVE GRAVEL PROPORTIONS

TERM	RANGE
A trace of gravel	Less than 4%
A little gravel	5 – 15%
With gravel	16 – 50%

RELATIVE SIZES

Boulder	Over 12"
Cobble	3" - 12"
Gravel - Coarse	¾" - 3"
Gravel – Fine	#4 - ¾"
Sand – Coarse	#4 - #10
Sand - Medium	#10 - #40
Sand - Fine	#40 - #200
Silt & Clay	-#200, Based on Plasticity

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PRECAUTIONS FOR EXCAVATING AND REFILLING DURING COLD WEATHER

The winter season in this area presents specific problems for foundation construction. Soils which are allowed to freeze undergo a moisture volume expansion, resulting in a loss of density. These frost-expanded soils will consolidate upon thawing, causing settlement of any structure supported on them. To prevent this settlement, frost should not be allowed to penetrate into the soils below any proposed structure.

Ideally, winter excavation should be limited to areas small enough to be refilled to a grade higher than footing grade on the same day. Typically, these areas should be filled to floor grade. Trenching back down to unfrozen soils for foundation construction can then be performed just prior to footing placement. The excavated trenches should be protected from freezing by means of insulating or heating during foundation construction. Backfilling of the foundation trenches should be performed immediately after the below-grade foundation construction is finished. In addition, any interior footings, or footings designed without frost protection should be extended below frost depth, unless adequate precautions are taken to prevent frost intrusion until the building can be enclosed and heated.

In many cases, final grade cannot be attained in one day's time, even though small areas are worked. In the event final grade cannot be attained in one day's time, frost can be expected to develop overnight. The depth of frost penetration can be minimized by leaving a layer of loose soil on top of the compacted material overnight. However, any frost which forms in this loose layer, or snow which accumulates, should be completely removed from the fill area prior to compaction and additional soil placement. Frozen soils, or soils containing frozen material or snow should never be used as fill material.

After the structure has been enclosed, all floor slab areas should be subjected to ample periods of heating to allow thawing of the soil system. Alternatively, the frozen soils can be completely removed and be replaced with an engineered fill. The floor slab areas should be checked at random and representative locations for remnant areas of frost, and density tests should be performed to document fill compaction prior to slab placement.

Due to the potential problems associated with fill placement during cold weather, any filling operations should be monitored by a full-time, on-site soils technician. Full-time monitoring aids in detecting areas of frozen material, or potential problems with frozen material within the fill, so that appropriate measures can be taken. The choice of fill material is particularly important during cold weather, since clean granular fill materials can be placed and compacted more efficiently than silty or clayey soils. In addition, greater magnitudes of heaving can be expected with freezing of the more frost susceptible silts and clays.

If more specific frost information or cold weather data concerning other construction materials is required, please contact us.

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CONSTRUCTION OBSERVATIONS AND TESTING

- **Geotechnical Engineer's Observation**

The recommendations made in this report have been made based on the subsurface conditions found in the borings. It is possible that there are soil and water conditions on-site that were not represented by those borings. Therefore, we recommend that the completed excavation and prepared subgrade be observed and tested by a Geotechnical Engineer prior to fill placement or construction of any foundation elements. These observations are necessary to judge if all unsuitable materials have been removed from within the planned construction area and that an appropriate degree of lateral oversize has been provided for in those areas where fill will be placed below the bottom of foundation grade.

- **Field Density Tests**

We recommend a representative number of field density tests be taken in the engineered fill to aid in judging its suitability. We suggest the following guidelines relative to the number and spacing of the density tests:

- Footing Trench Areas: At least one density test should be performed for each 1½ foot depth of engineered fill placed. The lateral spacing between each 1½ foot test should not exceed 30 lineal feet.
- Floor Slab Areas: At least one density test should be performed for each 1½ foot of engineered fill depth. The density tests should be spaced so that there is a minimum of one test performed for every 2000 square feet of engineered fill placed.
- Exterior Backfill Areas: At least one density test should be performed for each 2 feet of engineered fill depth and at least one test for every 30 lineal feet of engineered fill placed.
- Utility Trench Areas: At least one density test should be performed for each 2 feet of engineered fill depth and at least one test for every 50 lineal feet of engineered fill placed.

Additional tests should be taken in confined areas, such as building corners. The actual number of tests should be left to the discretion of a qualified engineer or his representative. Any proposed engineered fill material should be submitted to the laboratory for tests to check compliance with our recommendations and project specifications.

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IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences:'
The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration, the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering* report *should not be used:*

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage. or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced* owners *retain their geotechnical consultants through the construction stage,* to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering* report *whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer*

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A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report* prepared or authorized for their use. Those who do not provide such access may proceed under the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory

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SECTION 02 41 13 SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Protecting existing trees groundcovers plants and grass to remain.
2. Removing existing trees shrubs groundcovers plants and grass.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

PART 2 - PART 2 - PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - PART 3 - PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 UTILITIES

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

3.3 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.4 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within tree protection zones.
3. Dispose of excess topsoil as specified for waste material disposal.

3.5 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.6 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02 41 13

SECTION 02 41 16 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of a building or structure.
   2. Repair procedures for selective demolition operations.

B. Related Sections include the following:
   1. Division 1 Section "General Requirements".

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

1.7 PROJECT 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. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
   1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for condition of areas to be selectively demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site will not be 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.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.
   1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
   2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.
B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
   1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.
C. Utility Requirements: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

A. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.
B. Temporary Enclosures: Provide temporary enclosures for protection of existing building and 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 not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

3.4 POLLUTION CONTROLS

A. Dust Control: Use temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
   1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
   2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.
B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.
10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

C. Removed and Salvaged Items: Comply with the following:
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: Comply with the following:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

F. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

G. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

3.6 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

C. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

D. Floors and Walls: Where walls or partitions that are demolished 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 existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

E. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 02 41 16

SECTION 02 41 19 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Division 2 Section "Selective Demolition" for demolition of selected portions of the building.
2. Division Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
3. Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. 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.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related 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.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials 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 match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. 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.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. 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 as small as possible, neatly to 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. Proceed with patching after construction operations requiring cutting are complete.

C. 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 possible. Provide materials and comply with installation requirements specified in other Sections.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, apply primer and intermediate paint coats 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.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 02 41 19

SECTION 02 50 00 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Excavating and backfilling for buildings and structures.
   2. Drainage course for slabs-on-grade.
   3. Subsurface drainage backfill for walls and trenches.

B. Related Sections include the following:
   1. Division 2 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
   2. Division 3 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

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 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.

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. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.
   3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

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.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
   a. 24 inches outside of concrete forms other than at footings.
   b. 12 inches outside of concrete forms at footings.
   c. 6 inches outside of minimum required dimensions of concrete cast against grade.
   d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   e. 6 inches beneath bottom of concrete slabs on grade.
   f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.9 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.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, sub drainage, damp proofing, waterproofing, and perimeter insulation.
2. Removing concrete formwork.
3. Removing trash and debris.
4. Removing temporary shoring and bracing, and sheeting.
5. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 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 D 698:

1. Under structures, building slabs, steps, and pavements, scarify and compact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.

2. Under walkways, scarify and compact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under lawn or unpaved areas, scarify and compact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.15 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.16 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
1. 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 95 percent of maximum dry unit weight according to ASTM D 698.

3.17 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 compact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02 50 00

SECTION 03 30 00 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Installing sleeves for Mechanical and Electrical systems. Sleeves provided by others. Coordinate with M/E.
   5. Installing anchor bolts.

B. Related Sections include the following:
   1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.
   2. Division 2 Section "Cement Concrete Pavement" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.5 DELIVERY, STORAGE, AND HANDLING

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

B. Water stops: Store water stops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. 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 will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
B. Plain-Steel Wire: ASTM A 82, as drawn galvanized.
C. Deformed-Steel Wire: ASTM A 496.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type II, gray.
B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 1-1/2” nominal for footings, ¾” nominal all other reinforced concrete.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

2.7 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.
   1. Available Products:
      a. Fortifiber Corporation; Moistop Plus.
      b. Raven Industries Inc.; Dura Skrim 6.
      c. Reef Industries, Inc.; Griffolyn Type-65.
      d. Stego Industries, LLC; Stego Wrap, 10 mils.

2.8 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
   1. Available Products:
      a. Euclid Chemical Company (The); Euco Diamond Hard.
      b. L&M Construction Chemicals, Inc.; Seal Hard.
      c. Meadows, W. R., Inc.; Liqui-Hard.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Available Products:
      a. Euclid Chemical Company (The); Eucobar.
      b. L&M Construction Chemicals, Inc.; E-Con.
      c. Meadows, W. R., Inc.; Sealtight Evapre.
      d. Sika Corporation, Inc.; SikaFilm.
B. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
   1. Available Products:
      a. Euclid Chemical Company (The); Kurez DR VOX.
      b. L&M Construction Chemicals, Inc.; L&M Cure R.
      c. Meadows, W. R., Inc.; 1100 Clear.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C 1059, Type II, non-dispersible, acrylic emulsion or styrene butadiene.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days.
   2. Slump Limit: 5 inches for hand placed & hand vibrated, 3-1/2 inches for mechanically vibrated, 2 inches for air entrained.
   3. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
   4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days.
   2. Slump Limit: 5 inches for hand placed & hand vibrated, 3-1/2 inches for mechanically vibrated, 2 inches for air entrained.
   3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days.
   2. Minimum Cementitious Materials Content: 540 lb/cu. yd.
   3. Slump Limit: 5 inches for hand placed & hand vibrated, 3-1/2 inches for mechanically vibrated, 2 inches for air entrained.
   4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
   5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

2.13 FABRICATING REINFORCEMENT

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

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturers recommended tape.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 3/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: 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.

2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 TOLERANCES

A. Tolerances for slab on grade

1. The concrete surface installed must be level, steel troweled concrete slab to a tolerance of +/- 1/8” in a 10 foot radius. This contractor will be responsible for correcting any deviations in the tolerance specified.

3.9 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view,

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

3.10 FINISHING FLOORS AND SLABS

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

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Straighten, cut down high spots, and fill low spots. Repeat float passes and straightening until surface is left with a uniform, smooth, granular texture.

C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

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

3.11 MISCELLANEOUS CONCRETE ITEMS

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

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

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

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

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact

with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, pop outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
5. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
7. 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.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work,

design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

10. Nondestructive Testing: Impact hammer, son scope, 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: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
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 dos not comply with the Contract Documents.

END OF SECTION 03 30 00

SECTION 04 23 13 - THIN BRICK

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Thin brick veneer.

1.3 REFERENCES

A. ASTM C 67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

B. ASTM C 1088 - Standard Specification for Thin Veneer Brick Units Made From Clay or Shale.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

[Product Data]: Manufacturer's catalog data, detail sheets, and printed installation instructions.

final selection.

Verification Samples: For each product, color, and texture selected, provide two full-size units representing actual color and texture of products to be installed.

1.5 SAMPLE PANELS

Construct sample panel at location indicated or directed, and as follows:

Size: 4 feet by 4 feet (1.2 m by 1.2 m).

Include all unit types and sizes to be used, and mortar joint treatment.

Obtain architect's acceptance of sample panel before beginning construction activities of this section.

Do not remove sample panel until construction activities of this section have been accepted by architect.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver products of this section on pallets, with individual faces protected; keep dry.

Store units in protected area or under cover on level ground; keep dry. Do not double-stack pallets.

2.1 PRODUCTS

2.2 MANUFACTURERS

Acceptable Manufacturer: Endicott Clay Products Co., which is located at: 57120 707th Rd.; Endicott, NE 68350; Tel: 402-729-3315; Web: www.endicott.com

MATERIALS

Thin Brick: ASTM C 1088, Type TBX, tested in accordance with ASTM C 67, as manufactured by Endicott Clay Products Co.

Approved equals:

Hebron Brick Supply

I-29 Brick Supply

2.3 Texture: Wirecut.

Size: 3-5/8 inches high, 7-5/8 inches long, 1/2 inch thick.

Color: To be selected by owner from suppliers list.

Trim Units: Matching thin brick.

EXECUTION

EXAMINATION

Inspect related conditions; do not start work in an area until adverse conditions in that area are corrected.

PREPARATION

Test surfaces for straightness, levelness. Notify Architect where corrections are needed.

INSTALLATION

Install thin brick in accordance with manufacturer's printed instructions.

Cut units where required for fitting or for installation of built-in items, using power tools; do not install units having chipped or cracked edges on sight-exposed surfaces.

Align base courses to follow accurate floor lines.

Align faces plumb, level, and true, with uniform joint widths.

Size and portion units for best appearance, with joints arranged neat and symmetrical, free of imperfections detracting from overall appearance.

FIELD QUALITY CONTROL

Architect will observe appearance of installed units; installed masonry surfaces shall be free of imperfections which detract from overall appearance when viewed from a distance of 5 feet (1.5 m) at 90 degrees normal to surface.

CLEANING

Clean installed masonry surfaces in accordance with manufacturer's instructions; do not clean units with products not specified in manufacturer's instructions.

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Structural steel.
   2. Grout.

B. Related Sections include the following:
   1. Division 5 Section "Steel Deck" for field installation of shear connectors.
   2. Division 9 painting Sections for surface preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
   1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Load and Resistance Factor Design," Volume 2, Part 9.
   2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

B. Construction: Type 2, simple framing.

1.5 SUBMITTALS

A. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
   5. For structural-steel connections indicated to comply with design loads, include structural analysis data prepared by the qualified professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

A. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P3 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

C. Comply with applicable provisions of the following specifications and documents:
   1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
   3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
   4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
   5. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
   6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
   1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
   2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M ASTM A 572/A 572M, Grade 50.

B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.
D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
   1. Finish: Plain.
   2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
      a. Finish: Plain.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer. Oil based primer required @ exposed gym structure where dry-fall paint finish is indicated.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
   1. Camber structural-steel members where indicated.
   2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
   3. Mark and match-mark materials for field assembly.
   4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
E. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.
B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials.
B. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steelwithin AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.

b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

c. Ultrasonic Inspection: ASTM E 164.

d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

B. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 05 12 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Loose bearing and leveling plates.
   2. Loose steel lintels.
   3. Steel framing and supports for mechanical and electrical equipment.
   4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   5. Miscellaneous metal trim.
   6. Metal floor plate and supports.

B. Related Sections include the following:
   1. Division 5 Section "Structural Steel" for structural-steel framing system components.
   2. Division 6 Section "Rough Carpentry" for metal framing anchors and other rough hardware.

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Nonslip aggregates and nonslip-aggregate surface finishes.
   2. Paint products.
   3. Grout.

B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   1. Provide templates for anchors and bolts specified for installation under other Sections.

C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications 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.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.2, "Structural Welding Code--Aluminum."
   3. AWS D1.3, "Structural Welding Code--Sheet Steel."
   4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

F. Slotted Channel Framing: Cold-formed metal channels with flange edges returned toward web and with 9/16-inch- wide slotted holes in webs at 2 inches o.c.
   1. Width of Channels: 1-5/8 inches.
   2. Depth of Channels: 1-5/8 inches.
   3. Depth of Channels: As indicated.
   4. Metal and Thickness: Uncoated steel complying with ASTM A 570, Grade 33; 0.0966-inch minimum thickness.
   5. Finish: Hot-dip galvanized after fabrication.

G. Malleable-Iron Castings: ASTM A 47, Grade 32510.

H. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

I. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 ALUMINUM

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T6.

2.4 PAINT

A. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

B. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.3.

E. Lag Bolts: ASME B18.2.1.

F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.

G. Plain Washers: Round, carbon steel, ASME B18.22.1.

H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
   2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.6 GROUT

A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 CONCRETE FILL

A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.8 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. 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. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. 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.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.10 LOOSE STEEL LINTELS

A. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.11 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. General: Provide steel framing and supports indicated and as necessary to complete the Work.

C. Fabricate units from structural-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 retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
3. Furnish inserts if units must be installed after concrete is placed.

2.12 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

1. Exterior.
2. Interior, where indicated.

2.13 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.14 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
   1. ASTM A 123, for galvanizing steel and iron products.
   2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

2.15 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.16 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. 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.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. 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.

E. 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.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 SETTING 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 grout.
   1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING 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, if any.

3.4 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Steel pipe railings.

1.3 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
   2. Provide allowance for trimming and fitting at site.

1.6 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.2 STEEL AND IRON

A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

B. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.3 FASTENERS

A. General: Provide the following:
   1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated.

C. Fasteners for Interconnecting Railing Components:
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
   2. Provide tamper-resistant flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors: Provide cast-in-place anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections, unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Form changes in direction as follows:

1. By inserting prefabricated flush-elbow fittings.

J. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.7 STEEL AND IRON FINISHES

A. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

3.4 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with predrilled hole for exposed bolt anchorage.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.5 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 13

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Framing with dimension lumber.
   2. Framing with engineered wood products.

B. Related Sections include the following:
   1. Division 6 Section "Metal-Plate-Connected Wood Trusses."
   2. Division 6 Section "Sheathing" for sheathing and plywood backing panels.
   3. Division 6 Section “Finish Carpentry” for nonstructural carpentry items exposed to view and not specified in another Section.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NELMA - Northeastern Lumber Manufacturers Association.
   2. NLGA - National Lumber Grades Authority.
   3. SPIB - Southern Pine Inspection Bureau.
   4. WCLIB - West Coast Lumber Inspection Bureau.
   5. WWPA - Western Wood Products Association.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Laminated-Veneer Lumber:
      a. Boise Cascade Corporation.
      b. Georgia-Pacific Corporation.
      c. Louisiana-Pacific Corporation.
      d. Truss Joist MacMillan.

2.2 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   3. Provide dressed lumber, S4S, unless otherwise indicated.
   4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
   1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.3 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Joists, Rafters, and Other Framing Not Listed Above: Construction or No. 2 grade and the following species:
   1. Spruce-pine-fir; NLGA.

2.4 MISCELLANEOUS LUMBER

A. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species:
   1. Mixed southern pine; SPIB.
   2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
   3. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.
   4. Eastern softwoods; NELMA.
   5. Northern species; NLGA.
   6. Western woods; WCLIB or WWPA.

2.5 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber: A composite of wood veneers with grain primarily parallel to member lengths, manufactured with an exterior-type adhesive complying with ASTM D 2559. Product has the following allowable design values as determined according to ASTM D 5456:
   1. Extreme Fiber Stress in Bending, Edgewise: 2850 psi for 12-inch nominal- depth members.
   2. Modulus of Elasticity, Edgewise: 2,000,000 psi.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
B. Nails, Brads, and Staples: ASTM F 1667.
C. Power-Driven Fasteners: CABO NER-272.
D. Wood Screws: ASME B18.6.1.
E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
F. Lag Bolts: ASME B18.2.1..
G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
B. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. CABO NER-272 for power-driven fasteners.
   2. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in the Uniform Building Code.
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 between members. Install fasteners without splitting wood; predrill as required.
E. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 WOOD SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

3.3 WOOD FRAMING INSTALLATION, GENERAL

A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Do not splice structural members between supports.

D. Where built-up beams or girders of 2-inch nominal- dimension lumber on edge are required, fasten together with 2 rows of 20d nails spaced not less than 32 inches o.c. Locate one row near top edge and other near bottom edge.

END OF SECTION 06 10 00

SECTION 06 10 53 – MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Wood blocking, and nailers.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.
B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NLGA - National Lumber Grades Authority.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. 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 lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   3. Provide dressed lumber, S4S, unless otherwise indicated.
   4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.2 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.
B. Framing Other Than Non-Load-Bearing Partitions: Construction, Stud, or No. 2 grade and the following species:
   1. Spruce-pine-fir; NLGA.

2.3 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content and the following species:
   1. Northern species; NLGA.
C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
   1. Northern species, No. 2 Common grade; NLGA.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
B. Nails, Brads, and Staples: ASTM F 1667.
C. Power-Driven Fasteners: CABO NER-272.
D. Wood Screws: ASME B18.6.1.
E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
F. Lag Bolts: ASME B18.2.1..
G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.5 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in the Uniform Building Code.

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 between members. Install fasteners without splitting wood; predrill as required.

E. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

END OF SECTION 06 10 53

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Wall sheathing.
   2. Roof sheathing.
   3. Building wrap.
   4. Flexible flashing at openings in sheathing.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

A. Oriented Strand Board: DOC PS 2.
B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
C. Factory mark panels to indicate compliance with applicable standard.

2.2 WALL SHEATHING

A. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing.
   1. Span Rating: Not less than 24/0.
   2. Nominal Thickness: Not less than 7/16 inch.

2.3 ROOF SHEATHING

A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing.
   1. Span Rating: Not less than 24/0.
   2. Nominal Thickness: Not less than 5/8 inch.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
B. Nails, Brads, and Staples: ASTM F 1667.
C. Power-Driven Fasteners: NES NER-272.
D. Wood Screws: ASME B18.6.1.
E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
   1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

2.5 WEATHER-RESISTANT SHEATHING PAPER

A. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap.
      b. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.
      c. Raven Industries Inc.; Rufco-Wrap.
   2. Water-Vapor Permeance: Not less than 200 g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).
   3. Allowable UV Exposure Time: Not less than three months.
B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.6 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.025 inch.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
      b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Plus Self-Adhered Flashing.
      c. MFM Building Products Corp.; Window Wrap.
      d. Polyguard Products, Inc.; Polyguard 300.
      e. Protecto Wrap Company; PS-45.
      f. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. 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 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.

3.2 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

A. General: Cover sheathing with weather-resistant sheathing paper as follows:
   1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
   2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.

B. Building Wrap: Comply with manufacturer's written instructions.
   1. Seal seams, edges, fasteners, and penetrations with tape.
   2. Extend into jambs of openings and seal corners with tape.

END OF SECTION 06 16 00

SECTION 06 17 53 - METAL-PLATE-CONNECTED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes wood roof and girder trusses and truss accessories.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for roof sheathing and subflooring and dimension lumber for supplementary framing and permanent bracing.

1.3 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated.
2. Maximum Deflection Under Design Loads:
   a. Roof Trusses: Vertical deflection of 1/360 of span.
   b. Roof Trusses: Horizontal deflection at reactions of 1-1/4 inches.

1.5 SUBMITTALS

A. Shop Drawings: Show location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber; splice details; type, size, material, finish, design values, orientation, and location of metal connector plates; and bearing details.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with TPI quality-control procedures for manufacture of connector plates published in TPI 1.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that involves inspection by SPIB, Timber Products Inspection, TPI, or other independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. Source Limitations for Connector Plates: Obtain metal connector plates through one source from a single manufacturer.

D. Comply with applicable requirements and recommendations of the following publications:

1. TP1 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."

E. Wood Structural Design Standard: Comply with applicable requirements in AFPA's "National Design Specifications for Wood Construction" and it’s "Supplement."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with TPI recommendations to avoid damage and lateral bending. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.8 COORDINATION

A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Metal Connector Plates:
   a. Alpine Engineered Products, Inc.

b. CompuTruss, Inc.
c. Eagle Metal Products.
d. Jager Industries, Inc.
e. Mitek Industries, Inc.
f. Robbins Engineering, Inc.
g. TEE-LOK Corporation.
h. Truswal Systems Corporation.

2. Metal Framing Anchors:
a. Alpine Engineered Products, Inc.
b. Cleveland Steel Specialty Co.
c. Harlen Metal Products, Inc.
d. Silver Metal Products, Inc.
e. Simpson Strong-Tie Company, Inc.
f. United Steel Products Company, Inc.

2.2 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified.
3. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

B. Grade and Species: Provide dimension lumber of any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

2.3 METAL CONNECTOR PLATES

A. General: Fabricate connector plates to comply with TPI 1 from metal complying with requirements indicated below:

B. Hot-Dip Galvanized Steel Sheet: ASTM A 653/A 653M, G60 coating designation; Designation SS, Grade 33, and not less than 0.036 inch thick.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.5 METAL FRAMING ANCHORS

A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:
1. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

C. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/2 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, inside face of top plates, and both sides of stud below.

D. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

2.7 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. Before installing, splice trusses delivered to Project site in more than one piece.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not cut or remove truss members.

L. Replace wood trusses that are damaged or do not meet requirements.

1. Do not alter trusses in field.

3.2 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION 06 17 53

SECTION 07 21 00 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Foundation wall insulation (supporting backfill).
   2. Concealed building insulation.
   3. Vapor retarders.

B. Related Sections include the following:
   1. Division 9 Section "Gypsum Board Assemblies" for installation in metal-framed assemblies of insulation specified by reference to this Section.
   2. Division 15 Sections "Duct Insulation," "Equipment Insulation," and "Pipe Insulation."

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E 84.
   2. Fire-Resistance Ratings: ASTM E 119.
   3. Combustion Characteristics: ASTM E 136.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by 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 plastic insulation as follows:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Extruded-Polystyrene Board Insulation:
      a. DiversiFoam Products.
      b. Dow Chemical Company.
      c. Owens Corning.
      d. Tenneco Building Products.
   2. Glass-Fiber Insulation:
      a. CertainTeed Corporation.
      b. Johns Manville Corporation.
      c. Owens Corning.

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.
   1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively:
   1. Type IV, 1.60 lb/cu. ft., unless otherwise indicated.

C. Unfaced, Flexible Glass-Fiber Board Insulation: ASTM C 612, Type IA; ASTM C 553, Types I, II, and III; or ASTM C 665, Type I; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; and of the following properties:
   1. Nominal density of not less than 1.5 lb/cu. ft. nor more than 1.7 lb/cu. ft., thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F.
   2. Combustion Characteristics: Passes ASTM E 136.

D. Unfaced Mineral-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

2.3 VAPOR RETARDERS

A. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.4 AUXILIARY INSULATING MATERIALS

A. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

C. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:

D. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.

E. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.

1. Retain insulation in place by metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.

F. Place loose-fill insulation into spaces and onto surfaces as shown, either by pouring or by machine blowing to comply with ASTM C 1015. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

1. For cellulosic loose-fill insulation, comply with the Cellulose Insulation Manufacturers Association's Special Report #3, "Standard Practice for Installing Cellulose Insulation."

3.5 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.

C. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

E. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.6 PROTECTION

A. Protect installed insulation and vapor retarders 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 07 21 00

SECTION 07 41 13 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Factory-formed and field-assembled, standing-seam metal roof panels.

B. Related Sections include the following:
   1. Division 7 Section "Metal Wall Panels" for factory-formed metal soffit panels.
   2. Division 7 Section "Sheet Metal Flashing and Trim" for fascia, flashings and other sheet metal work not part of metal roof panel assemblies.
   3. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.3 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

B. Steel Sheet Thickness: Minimum thickness of base metal without metallic coatings or painted finishes.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 283 at the following test-pressure difference:
   1. Test-Pressure Difference: Negative 1.57 lbf/sq. ft..
   2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
   3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

C. Water Penetration: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
   1. Test-Pressure Difference: 20 percent of positive design wind pressure, but not less than 6.24 lbf/sq. ft. and not more than 12.0 lbf/sq. ft..
   2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
   3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

D. Water Absorption: Maximum 1.0 percent absorption rate by volume when tested according to ASTM C 209.

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift resistance class indicated.

F. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
   1. Fire/Windstorm Classification: Class 1A- 90.
   2. Hail Resistance: MH.

G. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
   1. Wind Loads: Determine loads based on the following minimum design wind pressures:
      a. 90 mph basic wind speed.
   2. Snow Loads: 40 lbf/sq. ft..
   3. Deflection Limits: Engineer metal roof panel assemblies to withstand design loads with vertical deflections no greater than 1/180 of the span.

H. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

I. Thermal Performance: Provide insulated metal roof panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 236 or ASTM C 518.

J. Solar Reflectance for Roofs with Slopes of 2:12 or Less: Initial solar reflectance of not less than 0.65 when tested according to ASTM E 903, and maintained, under normal conditions, solar reflectance of not less than 0.50 for 3 years after installation.

K. Solar Reflectance for Roofs with Slopes Steeper Than 2:12: Initial solar reflectance of not less than 0.25 when tested according to ASTM E 903, and maintained, under normal conditions, solar reflectance not less than 0.15 for 3 years after installation.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of metal roof panels through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal roof panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Surface-Burning Characteristics: Provide insulated metal roof panels having insulation core material with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 25 or less, unless otherwise indicated.
2. Smoke-Developed Index: 450 or less, unless otherwise indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal roof panels without field measurements, or allow for field-trimming of panels. Coordinate roof construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.8 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in Division 7 Section "Roof Accessories."

B. Coordinate metal panel roof assemblies with rain drainage work, flashing, trim, and construction of decks, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to:

   a. Low-slope, clip mounted standing seam roof, Varco Pruden SSR, 24 ga., 24 inches coverage, UL 90 Wind Uplift Rating.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to:
3. VP Buildings, Inc.; a United Dominion Company.
4. Behlen Mfg. Co.
5. Butler Manufacturing Company.
6. Chief Building Division
7. NuCor Mfg. Co.

2.2 PANEL MATERIALS

A. Panel Sealants:

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 wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.3 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

B. Self-Adhering, Polyethylene-Faced Sheet: ASTM D 1970, 40 mils thick minimum, consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied.

1. Available Products:
   a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "A."
   b. Grace, W. R. & Co.; Grace Ice and Water Shield.
   c. Henry Company; Perma-Seal PE.
   d. Johns Manville International, Inc.; Roof Defender.
   e. NEI Advanced Composite Technology; AC Poly Ice and StormSeal.
   f. Owens Corning; WeatherLock.
   g. Polyguard Products, Inc.; Polyguard Deck Guard.
   h. Protecto Wrap Company; Rainproof TM.

C. Slip Sheet: Building paper, minimum 5 lb/100 sq. ft., rosin sized.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating.

1. Fasteners for Roof Panels: Self-drilling or self-tapping 410 stainless or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal roof panels.
2. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be field assembled 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.

1. Steel Panel Systems: ColorKlad, Una-Clad or Pac-Clad.

2.6 ACCESSORIES

A. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
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- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

2.7 FABRICATION

A. General: Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, 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 Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the 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 Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal roof panel manufacturer.
   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal roof panel manufacturer for application but not less than thickness of metal being secured.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.
   1. 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.

B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Install fasciae and copings to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

3.3 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment and building-paper slip sheet on roof sheathing under metal roof panels, unless otherwise recommended by metal roof panel manufacturer. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under metal roof panels. Apply at locations indicated below, in shingle fashion to shed water, with lapped joints of not less than 2 inches.
   1. Apply on roof not covered by self-adhering sheet underlayment. Lap edges of self-adhering sheet underlayment not less than 3 inches, in shingle fashion to shed water.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under metal roof panels. Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply at locations indicated below, in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
   1. Roof perimeter for a distance up from eaves of 36 inches beyond interior wall line.
   2. Valleys, from lowest point to highest point, for a distance on each side of 18 inches. Overlap ends of sheets not less than 6 inches.
   3. Rake edges for a distance of 18 inches.
   4. Hips and ridges for a distance on each side of 12 inches.
   5. Roof to wall intersections for a distance from wall of 18 inches.

C. Apply slip sheet over underlayment before installing metal roof panels.

3.4 METAL ROOF PANEL INSTALLATION, GENERAL

A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cutting of metal roof panels by torch is not permitted.

2. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels.
3. Provide metal closures at peaks, rake edges, rake walls and each side of ridge and hip caps.
4. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install ridge and hip caps as metal roof panel work proceeds.
7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
8. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.

B. Fasteners:
1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.

3.5 FIELD-ASSEMBLED METAL ROOF PANEL INSTALLATION

A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended 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. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

3.6 ACCESSORY INSTALLATION

A. General: 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 roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13

SECTION 07 42 43 – COMPOSITE WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior panelized fiber-cement rainscreen cladding system and accessories.

1.2 DEFINITIONS

A. DBVR: Drained and back-ventilated rainscreen system; designed to drain and dry cavity entering water through drainage channels, weeps, and air ventilation.

PREINSTALLATION MEETINGS

B. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, composite panel Fabricator and Installer, composite panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects composite panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to composite panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect composite panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for composite panel assembly during and after installation.
8. Review procedures for repair of panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include details of panel dimensions, profiles, edge conditions, joints, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage.

C. Samples for Initial Selection: For each type of composite panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Composite Panels: 12 inches long by actual panel width. Include fasteners, closures, and other composite panel accessories. Submit custom color samples in paint manufacturer's standard size.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

1. Composite Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance to comparable code sections IBC 1404.16.1 and IBC 1703.5.
2. Composite Panel System Fabricator's Certified System Tests Reports: Certified system test reports showing system compliance with specific performance or third-party listing documenting compliance code section. Base performance requirements on composite panel system type provided.
   a. DBVR System: Tested to AAMA 509.

C. Field quality-control reports.
D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For composite panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by composite panel fabricator.
B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for composite panel fabrication and installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, composite panels, and other manufactured items so as not to be damaged or deformed. Package composite panels for protection during transportation and handling.
B. Unload, store, handle, and erect composite panels in a manner to prevent bending, cracking, warping, twisting, and surface damage.
C. Stack composite panels on platforms or pallets no more than two pallets high, covered with suitable weathertight and ventilated covering.
D. Store composite panels to ensure dryness, with positive slope for drainage of water. Do not store composite panels in contact with other materials that might cause staining, denting, or other surface damage. Ensure panels are fully dry before installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of composite panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate composite panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Warranty on Panel Material: Manufacturer agrees to replace fiber cement that fails within specified warranty period.

   1. Warranty Period: 20 years. See warranty for detailed information on terms, conditions and limitations.

B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace composite panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical Performance: Provide composite panel system in accordance with ASTM C1186.
   1. Wet Flexural Strength: Result: 1418 psi, Lower Limit: 1015 psi.
   2. Water Tightness: No water droplets observed on any specimen.
   3. Freeze-Thaw: No damage or defects observed.

4. Warm Water: No evidence of cracking, delamination, swelling, or other defects observed.
5. Heat-Rain: No crazing, cracking, or other deleterious effects, or surface or joint changes observed in any specimen.

B. Structural Performance: Provide composite panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E330/E330M:
1. Design Wind Loads: Minimum **58 psf.**
2. Deflection Limits: For wind loads, panel deflection no greater than L/120 of the span.

C. Thermal Expansion: Maximum 0.00000318 deg F to minus 1 when tested in accordance with ASTM E228.

D. Air Leakage: 1.53 cfm/sq. ft. or less in accordance with AAMA5094.

E. Water Penetration under Static Pressure: No water penetration to room side of assembly when tested for 15 minutes in accordance with ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: **2.86 lbf/sq. ft.**

F. Fire Propagation Characteristics: Composite panel wall assembly passes NFPA 285.

G. Surface-Burning Characteristics: Provide composite panels that meet the following values when tested in accordance with ASTM E84:
1. Flame-Spread Index: 0.
2. Smoke-Developed Index: 5.

H. Fire Resistance: Composite panel wall assembly passes ASTM E119.

I. Ignition Resistance: Composite panel passes NFPA 268.

2.2 COMPOSITE WALL PANELS

A. Composite Wall Panel Systems: Provide factory-formed and -assembled, composite wall panels fabricated from a pressed, stamped, and autoclaved mix of portland cement, fly ash, silica, recycled rejects, and wood fiber bundles; formed into profile for installation method indicated. Include attachment assembly components and accessories required for weathertight system.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Nichiha Architectural Wall Panels; Architectural Wall Panels or comparable product by one of the following:
a. Equitone.
b. Alucobond.
c. Swisspearl.

B. The Designer Series Illumination Custom Color AWP 3030
1. Panel Dimensions: **17-7/8 by 119-5/16 inches**.
2. Panel Thickness: **5/8 inch.**
3. Panel: Factory sealed on all six sides.
4. Profiles: None.
5. Color: C1 = Russet, C2 = Custom Color Xpressions
6. Accessory Components: Manufactured corners **with 3-1/2-inch**.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet with ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide Fabricator's standard sections as required for support and alignment of composite panel system.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Nichiha Architectural Wall Panels; Ultimate Starter Track or comparable product by one of the following:
a. Cembrit.
b. MEW USA Inc.
c. Swisspearl.

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 composite panels unless otherwise indicated.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Nichiha Architectural Wall Panels; Ultimate Clip System or comparable product by one of the following:
      a. Cembrit.
      b. MEW USA Inc.
      c. Swisspearl.

C. Flashing and Trim: Provide anodized aluminum flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Nichiha Architectural Wall Panels; Essential Flashing System or comparable product by one of the following:
      a. Equitone.
      b. Ceraclad.
      c. Swisspearl.
   2. Aluminum Trim: Formed with 0.040-inch thick, coil-coated aluminum sheet facings.
   3. Color: As selected by Architect from manufacturer's full range.

D. Panel Fasteners: Provide corrosion-resistant fasteners as required for construction method used.

E. Panel Sealants: ASTM C920, Class 35; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in composite panels and remain weathertight; and as recommended in writing by composite panel manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, composite panel supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by composite panel manufacturer.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by composite panel manufacturer.
      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating composite panels to verify actual locations of penetrations relative to seam locations of composite panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with composite panel manufacturer's written instructions.

3.3 COMPOSITE PANEL INSTALLATION

A. General: Install composite panels in accordance with Fabricator's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports

unless otherwise indicated. Anchor composite panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving composite panels.
2. Flash or seal composite panels at perimeter of all openings. Fasten flashing with manufacturer-approved fasteners. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by composite 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 composite panel work proceeds.
6. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Composite Panels: Use hot-dip galvanized, ceramic-coated, or stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Attachment Assembly, General: Install attachment assembly required to support composite wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

D. Panel Installation: Attach composite wall panels to supports at locations, at spacings, and with fasteners recommended in writing by Fabricator to achieve performance requirements specified.

1. DBVR Rainscreen System: Install using Fabricator's standard assembly with horizontal channel that provides support and secondary drainage assembly, draining at base of wall. Attach composite wall panels by placing panel clips to supports at locations, at spacings, and with fasteners recommended in writing by Fabricator.
    a. Track-Support Installation: Install support assembly at locations, at spacings, and with fasteners recommended in writing by manufacturer. Use Fabricator's standard horizontal [**tracks**] [**drain channels**] that provide support and secondary drainage assembly.
    b. Panel Installation:
        1) Attach composite wall panels by interlocking panel edges with Fabricator's standard clips.
    c. Joint Sealing: Seal all joints in accordance with AAMA 509. Do not apply sealants to joints unless otherwise indicated.

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 composite panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by composite panel Fabricator; or, if not indicated, provide types recommended in writing by composite system Fabricator.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, or SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. with no joints allowed within 24 inches corner or intersection. Where lapped expansion provisions cannot be used or would not be

sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Site Verifications of Conditions:
   1. Verify that conditions of substrate previously installed under other Sections are acceptable for composite system installation. Provide documentation indicating detrimental conditions to composite system performance.
   2. Once conditions are verified, composite system installation tolerances are as follows:
      a. Shim and align composite wall panel units within installed tolerance of 1/4 inch in 20 ft. non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Fabricator's Field Service: Engage a factory-authorized service representative to test and inspect completed composite wall panel installation, including accessories.
B. Composite wall panels will be considered defective if they do not pass test and inspections.
C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
D. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings, if any, as composite panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of composite panel installation, clean finished surfaces as recommended by composite panel manufacturer. Maintain in a clean condition during construction.
B. After composite panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
C. Replace composite panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074243

SECTION 07 52 19 - EPDM MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Adhered membrane roofing system.
   2. Roof insulation.

B. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
   3. Division 7 Section "Joint Sealants."

C. Unit Prices: Refer to Bid Form for description of Work in this Section affected by unit prices.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
   1. Base flashings and membrane terminations.
   2. Insulation fastening patterns.

C. Maintenance Data: For roofing system to include in maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Manufacturer Qualifications: A qualified manufacturer that has UL listing for membrane roofing system identical to that used for this Project.

C. Source Limitations: Obtain components for membrane roofing system [from same manufacturer as roofing membrane] [approved by roofing membrane manufacturer].

D. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
   1. Special warranty includes roofing membrane, base flashings, roof insulation, fasteners, cover boards and other components of membrane roofing system.
   2. Warranty Period: 15 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 EPDM ROOFING MEMBRANE

A. EPDM Roofing Membrane: ASTM D 4637, Type II, scrim or fabric internally uniform, flexible sheet made from EPDM, and as follows:
   1. Available Manufacturers:
      a. Carlisle SynTec Incorporated.
      b. Firestone Building Products Company.
      c. GenFlex Roofing Systems.
      d. Johns Manville International, Inc.
      e. Versico Inc.
   2. Thickness: 60 mils, nominal.
   3. Exposed Face Color: Black.

2.3 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard bonding adhesive.

D. Seaming Material: Manufacturer’s standard synthetic rubber polymer primer and 3 inch wide minimum butyl splice tape with release film.

E. Lap Sealant: Manufacturer's standard single-component sealant, color to match roofing membrane.

F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

G. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.4 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Expanded-Polystyrene Board Insulation: Type II, 1.5-lb/cu. ft. minimum density, square edged.
   1. Available Manufacturers:
      a. DiversiFoam Products.
      b. Dow Chemical Company.
      c. Owens Corning.
      d. Benchmark Foam Inc.

C. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.
   1. Available Manufacturers:
      a. Apache Products Company.
      b. Atlas Roofing Corporation.
      c. Carlisle SynTec Incorporated.
      d. Celotex Corporation.
      e. Firestone Building Products Company.
      f. GAF Materials Corp.
      g. GenFlex Roofing Systems.
      h. Johns Manville International, Inc.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

D. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

F. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

3.4 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Bonding Adhesive: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

D. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

E. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

F. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
   1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.

G. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

I. Install roofing membrane and auxiliary materials to tie in to existing roofing.

3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
   1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.8 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
   1. Owner: <**Insert name of Owner.**>
   2. Address: <**Insert address.**>
   3. Building Name/Type: <**Insert information.**>
   4. Address: <**Insert address.**>
   5. Area of Work: <**Insert information.**>
   6. Acceptance Date: <**Insert date.**>
   7. Warranty Period: <**Insert time.**>
   8. Expiration Date: <**Insert date.**>

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:
   1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
      a. lightning;
      b. peak gust wind speed exceeding 52 mph;

c. fire;
d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. vapor condensation on bottom of roofing; and
g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <**Insert day**> day of <**Insert month**>, <**Insert year**>.
1. Authorized Signature: <**Insert signature.**>
2. Name: <**Insert name.**>
3. Title: <**Insert title.**>

END OF SECTION 07 52 19

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:
   1. Manufactured through-wall flashing.
   2. Formed roof flashing and trim.
   3. Formed wall flashing and trim.
   4. Formed equipment support flashing.

B. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Division 7 Section "Metal Wall Panels" for factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
   3. Division 7 Section "Manufactured Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
   4. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
   5. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.6 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak-proof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 SHEET METALS

A. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: 24 Ga., Hot-dipped galvanized primed and Kynar finished one side as manufactured by ColorKlad, Pac-Clad, or Una-Clad.

2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.

B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
   1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
   2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
   3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
   4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Sealant: ASTM C 920, 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. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, and polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. 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.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   1. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
   1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.6 ROOF SHEET METAL FABRICATIONS

A. Drip Edges: Fabricate from the following material:
   1. Prepainted, Metallic-Coated Steel: 24 Ga., Hot-dipped galvanized primed and Kynar finished one side as manufactured by ColorKlad, Pac-Clad, or Una-Clad.

B. Eave, Rake and Hip Flashing: Fabricate from the following material:
   1. Prepainted, Metallic-Coated Steel: 24 Ga., Hot-dipped galvanized primed and Kynar finished one side as manufactured by ColorKlad, Pac-Clad, or Una-Clad.

C. Roof-Penetration Flashing: Fabricate from the following material:
   1. Prepainted, Metallic-Coated Steel: 24 Ga., Hot-dipped galvanized primed and Kynar finished one side as manufactured by ColorKlad, Pac-Clad, or Una-Clad.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:
   1. Prepainted, Metallic-Coated Steel: 24 Ga., Hot-dipped galvanized primed and Kynar finished one side as manufactured by ColorKlad, Pac-Clad, or Una-Clad.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
2. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel sheet.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch centers.

C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of formed through-wall flashing is specified in Division 4 Section “Stone Veneer Assemblies."

C. Openings Flashing in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder and sealants.

B. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

C. 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.

END OF SECTION 07 62 00

SECTION 07 71 00 - MANUFACTURED ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Gutters and downspouts.

B. Related Sections include the following:
   1. Division 7 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, scuppers, gutters and downspouts, trim and fascia units, roof expansion-joint covers, and miscellaneous sheet metal accessories.

1.3 SUBMITTALS

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide manufactured roof specialties capable of withstanding wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of manufactured roof specialty from one source and by a single manufacturer.

1.6 PROJECT CONDITIONS

A. Coordinate work of this Section with adjoining work for proper sequencing of each installation to ensure best-possible weather resistance and protection of materials and finishes against damage.

PART 2 - PRODUCTS

2.1 METALS

A. Galvanized Steel Sheets: ASTM A 653, G90 coating designation; commercial quality; at least 0.034 inch thick, unless otherwise indicated.

2.2 GUTTERS AND DOWNSPOUTS

A. Provide gutters and downspouts in shapes and sizes indicated, with mitered and welded corners. Include steel straps formed from at least 0.028-inch- thick, galvanized steel sheet; hangers or other attachment devices; screens; end plates; and trim and other accessories indicated or required for complete installation.

B. Additional Features: Provide items below fabricated from the same metal as gutters and downspouts.

C. Provide gutters and downspouts fabricated from the following metal:
   1. Zinc-coated galvanized steel sheet ASTM A653/Z 653M, G90 coating designation, as manufactured by ColorKlad, Pac-Clad, or Una-Clad:

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessories designed and manufactured to match and fit roof edge treatment system indicated.

B. Concealed Fasteners: Same metal as item fastened or other noncorrosive metal as recommended by manufacturer.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat.

E. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

F. Foam-Rubber Seal: Manufacturer's standard foam.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Finish manufactured roof specialties after fabrication and assembly if products are not fabricated from prefinished metals.

D. 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 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, roof edges, and parapets for suitable conditions for roof edge system installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Promptly remove protective film, if any, from exposed surfaces of finished metals. Strip with care to avoid damage to finish.

B. Prepare concrete, concrete masonry block, cement plaster, and similar surfaces to receive roof edge system specified. Install blocking, cleats, water dams, and other anchoring and attachment accessories and devices required.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Coordinate with installation of roof deck and other substrates to receive work of this Section and with vapor retarders, roofing insulation, roofing membrane, flashing, and wall construction, as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor products securely to structural substrates to withstand lateral and thermal stresses and inward and outward loading pressures.

B. Isolation: Where metal surfaces of units contact dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces or provide other permanent separation as recommended by aluminum producer.

C. Expansion Provisions: Install running lengths to allow controlled expansion for movement of metal components in relation not only to one another but also to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner sufficient to prevent water leakage, deformation, or damage.

3.4 CLEANING AND PROTECTING

A. Clean exposed metal surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

B. Protection: Provide protective measures as required to ensure work of this Section will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION 07 71 00

SECTION 07 84 13 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:
   1. Walls and partitions.

B. Related Sections include the following:
   1. Division 7 Section "Building Insulation" for safing insulation and accessories.
   2. Division 15 Sections specifying duct and piping penetrations.
   3. Division 16 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
   1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
   2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.

B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
   1. Penetrations located outside wall cavities.
   2. Penetrations located outside fire-resistive shaft enclosures.
   3. Penetrations located in construction containing fire-protection-rated openings.
   4. Penetrating items larger than 4-inch- diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.

B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:
   1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
   2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:.
      a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
      b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
         1) UL in "Fire Resistance Directory."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system 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 materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. 3M Fire Protection Products.
2. Tremco.
3. United States Gypsum Company.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
   a. Slag-/rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.

2.3 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 84 43 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes fire-resistive joint systems for the following:
   1. Head-of-wall joints.

B. Related Sections include the following:
   1. Division 7 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, indicated as determined by UL 2079.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

B. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
   1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
   2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
      a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
      b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, fire-resistive joint systems that may be incorporated into the Work include, but are not limited to, those systems indicated in the Fire-Resistive Joint System Schedule at the end of Part 3.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system 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 fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.5 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.

B. Head-of-Wall Fire-Resistive Joint Systems:
   1. Available UL-Classified Systems: HW-S.
   2. Assembly Rating: 1 hour.
   3. Nominal Joint Width: As indicated.

END OF SECTION 07 84 43

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
   1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Perimeter joints between materials listed above and frames of doors and windows.
      b. Other joints as indicated.
   2. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Perimeter joints of exterior openings where indicated.
      b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
      c. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      d. Other joints as indicated.
   3. Interior joints in the following horizontal traffic surfaces:
      a. Isolation joints in cast-in-place concrete slabs.
      b. Other joints as indicated.

B. Related Sections include the following:
   1. Division 8 Section "Glazing" for glazing sealants.
   2. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, 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 sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Single-Component Nonsag Urethane Sealant:
   1. Available Products:
      a. Sika Corporation, Inc.; Sikaflex - 1a.
      b. Sonneborn, Division of ChemRex Inc.; Ultra.

c. Sonneborn, Division of ChemRex Inc.; NP 1.
d. Tremco; Vulkem 116.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
   a. Use O Joint Substrates: galvanized steel.

D. Single-Component Nonsag Urethane Sealant:
1. Available Products:
   a. Pecora Corporation; Dynatrol I-XL.
   b. Sika Corporation, Inc.; Sikaflex - 15LM.
   c. Tremco; DyMonic.
   d. Tremco; Vulkem 921.
   e. Tremco; Vulkem 931.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
   a. Use O Joint Substrates: galvanized steel.

2.4 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, 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.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
   a. Metal.
   b. Glass.
   c. Porcelain enamel.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant

SECTION 08 13 00 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Steel doors.
   2. Steel door frames.
   3. Fire-rated door and frame assemblies.

B. Related Sections include the following:
   1. Division 8 Section "Flush Wood Doors" for wood doors installed in steel frames.
   2. Division 8 Section "Door Hardware (Scheduled by Naming Products)" for door hardware and weather stripping.
   3. Division 8 Section "Glazing" for glass in glazed openings in doors .
   4. Division 9 Section "Gypsum Board Assemblies" for spot-grouting frames installed in steel-framed gypsum board partitions.
   5. Division 9 Section "Painting" for field painting factory-primed doors and frames.

1.3 DEFINITIONS

A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.4 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B. Shop Drawings: Show the following:
   1. Elevations of each door design.
   2. Details of doors including vertical and horizontal edge details.
   3. Frame details for each frame type including dimensioned profiles.
   4. Details and locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, accessories, joints, and connections.

C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.5 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
   1. Test Pressure: Test at positive pressure.
   2. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Steel Doors and Frames:
      a. Amweld Building Products, Inc.
      b. Ceco Door Products; a United Dominion Company.

c. Curries Company.
d. Pioneer Industries Inc.
e. Republic Builders Products.
f. Steelcraft; a division of Ingersoll-Rand.

2.2 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.3 DOORS

A. General: Provide doors of sizes, thicknesses, and designs indicated.

B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush) 2 (Seamless).

C. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush) 2 (Seamless).

D. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

2.4 FRAMES

A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Frames of 0.053-inch- thick steel sheet for:
1. Door openings wider than 48 inches.
2. Level 1 steel doors.
3. Level 2 steel doors.
4. Level 3 steel doors, unless otherwise indicated.
5. Wood doors, unless otherwise indicated.

C. Supports and Anchors: Fabricated from not less than 0.042-inch- thick, electrolytic zinc-coated or metallic-coated steel sheet.
1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.

D. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.

C. Interior Door and Panel Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from the following material:
1. Cold-rolled steel sheet, unless otherwise indicated.
2. Metallic-coated steel sheet where indicated.

D. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.

E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

F. Clearances for Fire-Rated Doors: As required by NFPA 80.

G. Single-Acting, Door-Edge Profile: Square edge [Beveled edge, unless square edge is indicated].

H. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

I. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

J. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

K. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.
1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F or better.

L. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.

M. Frame Construction: Fabricate frames to shape shown.
1. Fabricate frames with mitered or coped and continuously welded corners at block wall locations.
2. Fabricate knock-down, drywall slip-on frames for in-place gypsum board partitions.
3. For exterior applications, fabricate frames with mitered or coped and continuously welded corners.
4. For interior applications, fabricate knock-down frames with mitered or coped corners, for field assembly.
5. Provide welded frames with temporary spreader bars.

N. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

O. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

P. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- thick steel sheet.
1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

2.6 FINISHES

A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
3. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
4. Install fire-rated frames according to NFPA 80.
5. For openings 90 inches or more in height, install an additional anchor at hinge and strike jambs.

C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
1. Fire-Rated Doors: Install within clearances specified in NFPA 80.
2. Smoke-Control Doors: Install to comply with NFPA 105.

3.2 ADJUSTING AND CLEANING

A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Solid-core doors with wood-veneer, faces.
   2. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
   1. Indicate dimensions and locations of mortises and holes for hardware.
   2. Indicate dimensions and locations of cutouts.
   3. Indicate requirements for veneer matching.
   4. Indicate fire ratings for fire doors.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
   1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
   1. Test Pressure: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
   2. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
   1. Warranty shall be in effect during the following period of time from date of Substantial Completion:
      a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Flush Wood Doors:
      a. Jeld-Wen Millwork Distribution
      b. Algoma Hardwoods Inc.
      c. Eggers Industries; Architectural Door Division.
      d. GRAHAM Manufacturing Corp.
      e. Mohawk Flush Doors, Inc.
      f. Weyerhaeuser Company.
      g. VT Industries
      h. Fenestra

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:
   1. Grade: Premium, with Grade AA faces.

2. Species and Cut: Red oak, plain sliced .
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces: Balance match.
5. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
6. Stiles: Same species as faces or a compatible species .

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:
1. Particleboard: ANSI A208.1, Grade LD-2.
2. Provide doors with either glued-block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.

B. Interior Veneer-Faced Doors:
1. Core: Particleboard.
2. Construction: Seven plies, either bonded or nonbonded construction.

C. Fire-Rated Doors:
1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as follows:
a. 5-inch top-rail blocking.
b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch midrail blocking, in doors indicated to have armor plates.
d. 5-inch midrail blocking, in doors indicated to have exit devices.
3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile matching face veneer, and laminated backing at hinge stiles for improved screw-holding capability and split resistance.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Field-Finished Doors: Refer to the following for finishing requirements:
1. Division 9 Section "Painting."

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Exterior and interior aluminum-framed storefronts.
      a. Glazing is retained mechanically with gaskets on four sides.

B. Related Sections include the following:
   1. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
   2. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
   1. Structural loads.
   2. Thermal movements.
   3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   4. Dimensional tolerances of building frame and other adjacent construction.
   5. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferred to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
      d. Noise or vibration created by wind and thermal and structural movements.
      e. Loosening or weakening of fasteners, attachments, and other components.
      f. Sealant failure.

B. Structural Loads:
   1. Wind Loads: As indicated on Drawings.

C. Deflection of Framing Members:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

D. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft..

F. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

G. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.4 SUBMITTALS

A. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.

B. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
   1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those

indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

B. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CMI Architectural Products, Inc.
2. EFCO Corporation.
3. Kawneer.
4. Tubelite Inc.
5. United States Aluminum.
6. Manko Windows 2450

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard medium stile extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.5 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.6 FABRICATION

A. Form aluminum shapes before finishing.

B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.

2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker complying with AAMA 611.

1. Color: Dark Bronze (DB).

be warranted by the manufacture to be free from defects in material and workmanship for a period of two years.

2.8 LOW ENERGY ELECTRO-MECHANICAL AUTOMATIC OPERATORS

Acceptable manufacturers and respective catalog numbers:

	LCN	BESAM
Electro-Mechanical Operator	9500 Sr. Swing	450 SERIES

Where low kinetic energy, as defined by ANSI/BHMA Standard A156.19, power operators are indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with the ADA for opening force and time to close standards.

Operator operation shall consist of Push button, push plate, switch-activated, manual or manual/electric power assisted Push 'N' Go opening with power boost closing and holding as specified in hardware sets.

Operators shall comply with ANSI A156.19, UL 325, and the American with Disabilities Act.

In event of power failure, make door operate manually with controlled spring close as though equipped with a #3 manual door closer, without damage to operator components.

Provide adjustment by microprocessor control for:

Opening speed.
Backcheck.
Hold-open, from 5 to 30 seconds.
Closing speed.
Opening force.
Acceleration during opening and recycling, for soft start.
Door will safely stop and reverse if an object is encountered in the opening or closing cycle.

Operator equipment shall be completely electromechanical and include the following features:

Close and center door against stop after each cycle, and hold against drafts, winds and stack pressure.
Manual opening force: 14 lb-force (62 N) maximum.
Closing force: 6 lb-force (26.6 N).
Factory-set door hold-open voltage.
Control box and motor/gear box shall be contained in protective housing; utilize precision-machined gears and bearing seats, all-weather lubricant, and shall be mounted on vibration isolators.
Gears shall be manufactured by operator manufacturer specifically for operators.
Motor shall consist of a DC permanent magnet motor with shielded ball bearings. Motor shall stop when door stops or is fully open and when breakaway is operated.
Door operating arm shall be fabricated from forged steel and attached at natural pivot point of door. Do not use slide block in top of door.
Exposed arms shall be factory-polished and finished to match operator enclosure.
Control circuits for actuators and safeties shall be low-voltage, NEC Class II.
Power operators will require 115 VAC power supply.

Enclosure shall consist of a extruded aluminum header concealing all operating parts except arms and manual control switches.

Wall mounted actuators shall consist of a 4-1/2 inch diameter stainless steel touch plate with a blue filled handicapped symbol. Switches shall be weather resistant and mount on a single gang electrical box furnished by Division 16.

Power Operators shall be warranted by the manufacture to be free from defects in material and workmanship for a period of two years.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Install glazing as specified in Division 8 Section "Glazing."

G. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

H. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
   1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
   2. Alignment:
      a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
      b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
   3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

PART 4 – HARDWARE

4.1 Hardware for aluminum entrances shall be furnished and installed on the doors by the door manufacturer. Finish of hardware shall closely match doors. Lock cylinders included with finish hardware.

ALUMINUM FRAMED ENTRANCES & STOREFRONTS HARDWARE SCHEDULE

Hardware Schedule No. 01

3 – BUTT HINGES BY DOOR MANUF	
1 – CD9947NL-OP PANIC 3’	VON
1 – 8190HD-0 OFFSET PULL	IVE
1 – CYLINDERS	SCH
1 – 4040XP CUSH CLOSER	LCN
1 – SW200I AUTO OPERATOR	BSM
2 – WIRELESS ACTUATORS W/ TRANSMITTERS & RECEIVER	BEA
1 – C607A SWEEP 3’	NGP
1 – 425 THRESHOLD 36”	NGP

Hardware No. 02

Door 2 Door to have:

		HINGES AS REQUIRED	
1 EA	PUSH/PULL	9103HD-33-0	IVE
1 EA	CLOSER	4040XP CUSH	LCN
1 EA	PLATE	4040XP 18PA	LCN
1	SW200I AUTO OPERATOR		BSM
2	WIRELESS ACTUATORS W/ TRANSMITTERS & RECEIVER		BEA

Hardware No. 03

Door 14 Door to have:

		HINGES AS REQUIRED	
1 EA	PUSH/PULL	9103HD-33-0	IVE
1 EA	SURFACE CLOSER	4040XP S CUSH	LCN
1 EA	PLATE	4040XP 18PA	LCN

Hardware No. 04

Door 15 Door to have:

		HINGES AS REQUIRED	
1 EA	PANIC DEVICE	CD9947NL-OP	VON
1 EA	CYLINDER		SCH
1 EA	OFFSET PULL	8103-0	IVE
1 EA	SURFACE CLOSER	4040XP S-CUSH	LCN
1 EA	DROP PLATE	AS REQUIRED	
1 EA	DRIP CAP	142	ZER
1 EA	DOOR SWEEP	8198	ZER

WEATHERSTRIPPING BY DOOR MANUFACTURER

END OF SECTION 08 41 13

SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes fixed aluminum-framed windows for exterior locations.

B. Related Sections include the following:

1. Division 8 Section "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.

1.3 DEFINITIONS

A. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:

1. AW: Architectural.
2. HC: Heavy Commercial.
3. C: Commercial.
4. LC: Light Commercial.
5. R: Residential.

B. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:

1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.

C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

D. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:

1. Size indicated on Drawings in a schedule.

B. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:

1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.

C. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.5 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Expansion provisions.
4. Flashing and drainage details.
5. Weather-stripping details.
6. Thermal-break details.
7. Glazing details.
8. Window cleaning provisions.

B. Maintenance Data: For operable window sash, operating hardware, weather stripping and finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Do not modify size and dimensional requirements.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1. Provide AAMA-certified aluminum windows with an attached label.

F. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:

B. Fixed window framing shall be T-14000 Series Flush Glaze (2” X 4 ½”) as manufactured by Tubelite, Inc., Reed City, Michigan. Approved equals are:

1. DeSCo Windows.
2. EFCO Corporation.
3. Graham Architectural Products Corp.
4. Kawneer; an Alcoa Company.
5. Winco Window Company.

2.2 WINDOW

A. Window Type: As indicated on Drawings.

B. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.

1. Performance Class and Grade: HC40.

2.3 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.

C. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

1. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.
2. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.
3. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.

D. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

1. Vertically Pivoted Windows: Provide double-row weather stripping.

E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

F. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.

G. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

H. Glazing Stops: Provide snap-on glazing stops coordinated with Division 8 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: 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.

2.5 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Dark Bronze: 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 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches of opening.
3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain window operating system. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 08 51 13

SECTION 08 51 23 - STEEL WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Cold-formed, welded steel windows.

B. Related Sections include the following:
   1. Division 7 Section "Joint Sealants" for sealing perimeter joints between windows and adjacent materials.
   2. Division 8 Section "Glazing" for glazing requirements for steel windows, including those specified to be factory glazed.
   3. Division 8 Section "Security Glazing" for security glazing requirements for steel windows, including those specified to be factory glazed.
   4. Division 9 Section "Painting" for field painting of factory prime-coated windows.
   5. Division 16 Sections for electrical service and connections for motor operators or electrically activated release devices for fire-rated operable windows.

C. Alternates: Refer to Division 1 Section "Alternates" for description of Work in this Section affected by alternates.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide steel windows capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated:

B. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F 588.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for steel windows.

B. Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and the following:
   1. Layout and installation details, including anchors.
   2. Elevations of continuous work at 1/4 inch = 1 foot scale and typical window unit elevations at 3/4 inch = 1 foot scale.
   3. Full-size section details of typical composite members, including reinforcement.
   4. Hardware, including operators.
   5. Accessories.
   6. Glazing details.
   7. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Warranties: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to steel window manufacturer for installation of units required for this Project.

B. SWI Publication: Comply with applicable requirements in SWI's "The Specifier's Guide to Steel Windows" except where more stringent requirements are indicated.

C. Fire-Test-Response Characteristics: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to the test method indicated.
   1. Positive-Pressure Test: ASTM E 2010.
   2. Neutral-Pressure Test: UL 9.
   3. Fire-Protection Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
   4. Provide steel windows labeled with appropriate markings of applicable testing and inspecting agency.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify steel window openings by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating steel windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel windows that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to meet performance requirements.
      b. Structural failures including excessive deflection.
      c. Water leakage or air infiltration.
      d. Faulty operation of operable sash and hardware.
      e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Three year(s) from date of Substantial Completion.
   3. Warranty Period for Metal Finishes: Five years from date of Substantial Completion.
   4. Warranty Period for Glass: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Cold-Formed Steel Windows:
      a. DV Fyre-Tec, Inc.
      b. Optimum Window Manufacturing Corp.

2.2 MATERIALS

A. Cold-Formed Steel Window Members: Provide frame and ventilator members mechanically formed from metallic-coated, low-carbon, cold-rolled steel sheet complying with ASTM A 653. For combined weight of frame and ventilator members and front-to-back depth of frame or ventilator members, comply with the following requirements:
   1. Commercial and Industrial Windows: Not less than 2.75 lb/ft. in combined weight, and not less than 1-1/4 inches deep.

B. Trim members, screen frames, retainers for weather stripping, flashing, and similar items shall be manufacturer's standard**.**

C. Glazing beads shall be manufacturer's standard**.**

D. Fasteners: Provide fasteners of bronze, brass, stainless steel, or other metal, that are warranted by manufacturer to be noncorrosive and compatible with trim, hardware, anchors, and other components of steel windows.
   1. Exposed Fasteners: If exposed fasteners are used, provide Phillips flat-head machined screws that match finish of member or hardware being fastened, as appropriate.

E. Anchors, Clips, and Window Accessories: Provide units of stainless steel, hot-dip zinc-coated steel, bronze, brass, or iron complying with ASTM A 123. Provide units with sufficient strength to withstand design pressure indicated.

2.3 GLAZING

A. Glass and Glazing Materials: Refer to Division 8 Section "Glazing" for glass units and glazing requirements for steel windows.

2.4 HARDWARE

A. General: Provide manufacturer's standard nonremovable, hardware, with operating components of stainless steel, carbon steel complying with AAMA 907, brass, bronze, or other corrosion-resistant material designed to operate smoothly, to close tightly, and to lock steel window ventilators securely. Provide hardware of sufficient strength to accommodate size and weight of ventilator for which it is intended.

B. Horizontal-Sliding Windows: Provide the following operating hardware:
   1. Sash Rollers: Steel, lubricated ball-bearing rollers.
   2. Sash Lock: Manufacturer's standard latch.
   3. Limit Device: Manufacturer's standard.
   4. Pull Handle: Manufacturer's standard.

2.5 ACCESSORIES

A. General: Provide manufacturer's standard accessories that comply with indicated standards.

2.6 FABRICATION

A. General: Fabricate steel windows of type and in sizes indicated to comply with SWI standards. Include a complete system for assembly of components and anchorage of window units.
   1. Provide units that are reglazable without dismantling ventilator framing.

B. Window Types: Provide the following types of steel windows:
   1. Fixed windows.
   2. Horizontal sliding windows.

C. Subframes and operable ventilators: Formed of steel of profile indicated. Miter or cope corners, and weld and dress joints smooth.
   1. Repair galvanized coating damaged by fabrication, according to ASTM A 780.

D. Provide mullions and cover plates formed of cold-formed steel matching window units, with anchors for support to structure and for installation of window units. Provide mullions of profile indicated. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections.

E. Glazing Beads: Provide screw-applied glazing beads; coordinate with glass selection and glazing system as indicated. Finish glazing beads to match window units if fabricated of steel; otherwise, provide manufacturer's standard finish.

F. Glazing Clips: Where face glazing (without glazing beads) is indicated, furnish glazing clips for concealment in glazing compound.

2.7 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Surface Preparation: Clean surfaces of dirt, oil, grease, scale, and other contaminants; follow with a zinc-phosphate pretreatment applied according to window manufacturer's written recommendations.

C. Shop Prime Coat Finish: After fabrication, provide manufacturer's standard epoxy prime coat of 1.0-mil dry film thickness, and oven dry for 30 minutes at 300 deg F.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances, rough opening dimensions, levelness of sill plate, coordination with wall flashings and vapor retarders, and other conditions affecting performance of work.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, operators, accessories, and other components.

B. Install windows level, plumb, and true to line, without distortion. Anchor securely to surrounding construction with approved fasteners.

1. Separate corrodible surfaces subject to electrolytic action at points of contact with other materials.

C. Set sill members in a bed of sealant or with gaskets, as indicated, for weathertight construction.

1. Seal exterior joints between window frame and opening substrate with sealant.

D. Repair abraded areas of factory-applied finishes.

3.3 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware,and accessories for a tight fit at contact points. Lubricate hardware and moving parts.

3.4 CLEANING AND PROTECTION

A. Clean factory-finished steel surfaces immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

B. Protect window surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 51 23

SECTION 08 71 00 – DOOR HARDWARE (SCHEDULED BY NAMING PRODUCTS)

GENERAL

1.1 CONDITIONS

A. Conditions of the contract (General and Supplementary Conditions) and Division One General Requirements, govern the work of this section.

B. This section includes all material, and related service necessary to furnish all finish hardware indicated on the drawings or specified herein.

C. Furnish UL listed hardware for all labeled and 20 min. openings in conformance with the requirements for the class of opening scheduled. Underwriters' requirements shall have precedence over specification where conflicts exist.

D. All work shall be in accordance with all applicable state and local building codes. Code requirements shall have precedence over this specification where conflicts exist.

1.2 WORK INCLUDED

A. This section includes the following:

1. Furnish door hardware (for hollow metal, wood doors) specified herein, listed in the hardware schedule, and/or required by the drawings.
2. Cylinders for Aluminum Doors
3. Thresholds and Weather-stripping (Aluminum frame seals to be provided by aluminum door supplier)
4. Electro-Mechanical Devices
5. Access Control components and or systems specified within this section.

B. Where items of hardware are not definitely or correctly specified and is required for the intended service, such omission, error or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise furnish such items in the type and quantity established by this specification for the appropriate service intended.

1.3 RELATED WORK IN OTHER SECTIONS

A. This section includes coordination with related work in the following sections:

1. Division 6 Section "Finish Carpentry".
2. Division 6 Section "Cabinet Hardware"
3. Division 8 Section "Hollow Metal Doors and Frames".
4. Division 8 Section "Wood Doors"
5. Division 8 Section "Aluminum Entrances and Storefronts"

1.4 REFERENCES

A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.

1. DHI - Recommended Locations for Builders' Hardware.
2. NFPA 80 - Standards for Fire Doors and Windows.
3. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
4. UL - Building Material Directory.
5. DHI - Door and Hardware Institute
6. WHI - Warnock Hersey
7. BHMA - Builders Hardware Manufacturers Association
8. ANSI – American National Standards Institute
9. IBC 2009 - International Building Code 2009 Edition (as amended by local building code)

1.5 SUBMITTALS

A. Within ten days after award of contract, submit detailed hardware schedule in quantities as required by Division 1 - General Conditions.

B. Schedule format shall be consistent with recommendations for a vertical format as set forth in the Door & Hardware Institute's (DHI) publication "Sequence and Format for the Hardware Schedule". Hardware sets shall be consolidated to group multiple door openings which share similar hardware requirements. Schedule shall include the following information:
   1. Door number, location, size, handing, and rating.
   2. Door and frame material, handing.
   3. Degree of swing.
   4. Manufacturer
   5. Product name and catalog number
   6. Function, type and style
   7. Size and finish of each item
   8. Mounting heights
   9. Explanation of abbreviations, symbols, etc.
   10. Numerical door index, indicating the hardware set/ group number for each door.

C. The schedule will be prepared under the direct supervision of a certified Architectural Hardware Consultant (AHC) employed by the hardware distributor. The hardware schedule shall be signed and embossed with the DHI certification seal of the supervising AHC. The supervising AHC shall attend any meetings related to the project when requested by the architect.

D. Check the specified hardware for suitability and adaptability to the details and surrounding conditions.

E. Review drawings from related trades as required to verify compatibility with specified hardware. Indicate unsuitable or in compatible items, and proposed substitutions in the hardware schedule.

F. Provide documentation for all hardware to be furnished on labeled fire doors indicating compliance with positive pressure fire testing UL 10C.

G. Furnish manufacturers' catalog data for each item of hardware in quantities as required by Division 1 - General Conditions.

H. Submit a sample of each type of hardware requested by the architect. Samples shall be of the same finish, style, and function as specified herein. Tag each sample with its permanent location so that it may be used in the final work.

I. Furnish with first submittal, a list of required lead times for all hardware items.

J. After final approved schedule is returned, transmit corrected copies for distribution and field use in quantities as required by Division 1 - General Conditions.

K. Furnish approved hardware schedules, template lists, and pertinent templates as requested by related trades.

L. Furnish necessary diagrams, schematics, voltage and amperage requirements for all electro-mechanical devices or systems as required by related trades. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.

M. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner's representative to determine keying requirements. Upon completion of the initial key meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute's publication "Keying Procedures, Systems, and Nomenclature". Submit copies of owner approved key schedule for review and field use in quantities as required by Division 1 - General Conditions. Wiring diagrams shall be included in final submittals transmitted for distribution and field use.

1.6 QUALITY ASSURANCE

A. Manufacturers and model numbers listed are to establish a standard of function and quality. Similar items by approved manufacturers that are equal in design, function, and quality, may be considered for prior approval of the architect, provided the required data and physical samples are submitted for approval as set forth in Division One General Requirements.

B. Where indicated in this specification, products shall be independently certified by ANSI for compliance with relevant ANSI/BHMA standards A156.1 - A156.36 – Standards for Hardware and Specialties. All products shall meet or exceed certification requirements for the respective grade indicated within this specification. Supplier shall provide evidence of certification when requested by the architect.

C. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

D. Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. When electronic hardware components other than those indicated in hardware sets are provided, the supplier shall be responsible for all costs incurred by the design team and their consultants to review, and revise electrical drawings and electrical specifications. Supplier shall also be responsible for any additional costs associated with required changes in related equipment, materials, installation, or final hook up to insure the system will operate and function as indicated in the construction documents, including hardware set operational / functional descriptions.

E. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.

F. Hardware supplier shall be factory trained and certified by the manufacture to provide and support all computer managed locks and system components.

G. Installation of hardware shall be installed or directly supervised and inspected by a skilled installer certified by the manufacturer of locksets, door closers, and exit devices used on the project, or with not less than 3 years’ experience in successful completion of projects similar in size and scope.

H. Provide hardware for all labeled fire doors, which complies with positive pressure fire testing UL 10C.

I. Comply with all applicable provisions of the standards referenced within section 1.4 of this specification.

J. Hardware supplier shall participate when reasonably requested to meet with the contractor and or architect to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy of any unresolved items.

1.7 DELIVERY, STORAGE AND HANDLING

A. Hardware supplier shall deliver hardware to the job site unless otherwise specified.

B. All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.

C. Coordinate with contractor prior to hardware delivery and recommend secure storage and protection against loss and damage at job site.

D. Contractor shall receive all hardware and provide secure and proper protection of all hardware items to avoid delays caused by lost or damaged hardware. Contractor shall report shortages to the Architect and hardware supplier immediately after receipt of material at the job site.

E. Coordinate with related trades under the direction of the contractor for delivery of hardware items necessary for factory installation.

1.8 PRE-INSTALLATION MEETING

A. Schedule a hardware pre-installation meeting on site to review and discuss the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.

B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Door Hardware Installers (including low voltage hardware), Manufacturers representatives for above hardware items, and any other effected subcontractors or suppliers.

C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

1.9 WARRANTY

A. All hardware items shall be warranted against defects in material and workmanship as set forth in Division One General Requirements.

B. Repair, replace, or otherwise correct deficient materials and workmanship without additional cost to owner.

PART 2 - PRODUCTS

2.1 FASTENERS

A. All exposed fasteners shall be Phillips head or as otherwise specified, and shall match the finish of the adjacent hardware. All fasteners ex-posed to the weather shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate surrounding conditions.

B. Coordinate required reinforcements for doors and frames. Seek approval of the architect prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

2.2 BUTT HINGES

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Stanley	Hager	McKinney
1. Standard Weight, Plain Bearing	5PB1	F179	1279	T2714
2. Standard Weight, Ball Bearing	5BB1	BB179	BB1279	TB2714
3. Standard Weight, Ball Bearing, Non-Ferrous	5BB1	FBB191	BB1191	TB2314
4. Heavy Weight, Ball Bearing	5BB1HW	FBB168	BB1168	T4B3786
5. Heavy Weight, Ball Bearing, Non-Ferrous	5BB1HW	FBB199	BB1199	T4B3386

B. Unless otherwise specified, furnish the following hinge quantities for each door leaf.

1. 3 hinges for doors up to 90 inches.
2. 1 additional hinge for every 30 inch on doors over 90 inches.
3. 4 hinges for Dutch door applications.

C. Unless otherwise specified, top and bottom hinges shall be located as specified in division 8 Section "Hollow Metal Doors and Frames". Intermediate hinges shall be located equidistant from others.

D. Unless otherwise specified, furnish hinge weight and type as follows:

1. Standard weight: plain bearing hinge 5PB1 for interior openings through 36 inches wide without a door closer.
2. Standard weight: ball bearing hinge 5BB1 for interior opening over 36 through 40 inches wide without a door closer, and for interior openings through 40 inches wide with a door closer.
3. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
4. Heavyweight: 4 ball bearing hinge 5BB1HWss for exterior openings unless otherwise listed in groups.

E. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.

F. Unless otherwise specified, furnish hinges in the following sizes:

1. 5" x 5" 2-1/4" thick doors
2. 4-1/2" x 4-1/2" 1-3/4" thick doors
3. 3-1/2" x 3-1/2" 1-3/8" thick doors

G. Furnish hinges with sufficient width to accommodate trim and allow for 180-degree swing.

H. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins at interior doors, non-removable loose pins (NRP) at exterior and out-swinging interior doors.

I. Unless otherwise specified, furnish all hinges to template standards.

2.3 POWER TRANSFERS

A. Acceptable manufacturers and respective catalog numbers:

	Von Duprin	ASSA	ABH
1. Concealed Two Wire	EPT-2	CEPT-10	PT200
2. Concealed Ten Wire	EPT-10	CEPT-10	PT1000

B. Concealed power transfers shall be concealed in the door and frame when the door is closed.

C. Concealed power transfers shall have a steel tube to protect wires from being cut.

D. Concealed power transfers with spring tubes shall be rejected.

E. Concealed power transfers shall be supplied with a mud box to house all terminations.

F. Provide all bottom flush bolts with non-locking dust proof strikes.

2.4 EXIT DEVICES

A. Acceptable manufacturers and respective catalog numbers:

		Von Duprin	Detex
1.	Wide Stile, Push Pad	98 / 99 Series	Advantex (Wide Stile)
2.	Narrow Stile, Push Pad	33 / 35 Series	Advantex (Narrow Stile)

B. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.

C. All exit devices shall be equipped with a sound-dampening feature to reduce touch pad return noise.

D. On full glass doors there shall be no exposed fasteners on the back of the mechanism visible through the glass.

E. All exit devices shall be provided with flush end caps to reduce potential damage from impact.

F. All exit devices shall be provided with dead-locking latch bolts to insure security.

G. All exit devices shall be U.L. listed for accident hazard. Exit device for use on fire doors shall also be U.L. listed for fire exit hardware.

H. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.

I. Coordinate with related trades to insure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.

J. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)

K. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.

L. Unless specific exit device dogging options are noted within hardware sets, provide dogging options as follows:

M. Fire Rated devices: Dogging not permitted.

N. Non-Rated Exit Only functions not equipped with outside trim or pull: Less Dogging.

O. Non-Rated Classroom functions: Less Dogging.

P. Non-Rated devices utilizing electric latch retraction or electrified outside trim: Less Dogging.

Q. All Other Non-Rated devices: Cylinder Dogging utilizing interchangeable core cylinders. Cylinder keyway shall match locksets furnished on this project.

R. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.

S. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.

T. Provide reinforced crossbars for all traditional style exit devices applied to doors over 36" wide.

2.5 LOCKS AND LATCHES

A. Acceptable manufacturers and respective catalog numbers:

		Schlage	Corbin
1.	Grade 1 Cylindrical	AL Series ATH	CL3300 AZD

B. Unless otherwise specified, all locks and latches to have:

1. 2-3/4" Backset
2. 1/2" minimum throw latchbolt
3. 1" throw deadbolt
4. 6 pin cylinders
5. ANSI A115.2 strikes

C. Provide guarded latch bolts for all locksets, and latch bolts with sufficient throw to maintain fire rating of both single and paired door assemblies.

D. Length of strike lip shall be sufficient to clear surrounding trim.

E. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

2.6 CLOSERS

A. Acceptable manufacturers and respective catalog numbers:

	LCN	Sargent
1.	1450 /1451 EDA	281 / 281P10

B. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.

C. Provide extra heavy duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.

D. Closers shall use high strength cast cylinders, forged main arms, and 1 piece forged steel pistons.

E. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.

F. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.

G. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.

H. Provide closers with adjustable spring power. Size closers to insure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.

I. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.

J. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.

2.7 KICK PLATES AND MOP PLATES

A. Furnish protective plates as specified in hardware groups.

B. Where specified, provide 10" kick plates, 34" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.

C. Protective plates shall be 2" less door width, or 1" less door width at pairs. All protective plates shall be beveled 4 sides and counter sunk. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing.

D. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.

E. Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

2.8 OVERHEAD STOPS

A. Acceptable manufacturers and respective catalog numbers:

	Glynn-Johnson	Rixson	Sargent
1. Heavy Duty Surface Mount	GJ900 Series	9 Series	590

B. Unless otherwise specified, furnish GJ900 series overhead stop for hollow metal or 1-3/4” solid core doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for hollow metal or 1-3/4” solid core doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.

C. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.

D. Provide special stop only (“SE” suffix) overhead stops when used in conjunction with electronic hold open closers.

E. Do not provide holder function for labeled doors.

2.9 WALL STOPS AND HOLDERS

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Hager	Burns
1. Wrought Convex Wall Bumper	WS406CVX	232W	570
2. Wrought Concave Wall Bumper	WS406CCV	236W	575

B. Furnish a stop or holder for all doors. Furnish floor stops or hinge pin stops only where specifically specified.

C. Where wall stops are not applicable, furnish overhead stops.

D. Do not provide holder function for labeled doors.

2.10 WEATHERSTRIP, GASKETING

A. Acceptable manufacturers and respective catalog numbers:

	Zero	Pemko	NGP	Reese
1. Weatherstrip	429	2891_PK	700NA	755
2. Adhesive Gasket	188	S88	5050	797
3. Sweep w/ drip	8198	345_N	C627	354
4. Drip Cap	142	346	16	R201

B. Where specified in the hardware groups, furnish the above products unless otherwise detailed in groups.

C. Provide weatherstripping all exterior doors and where specified.

D. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.

E. Provide Zero 188 smoke gaskets at all fire rated doors and smoke and draft control assemblies.

F. Provide gasketing for all meeting edges on pairs of fire doors. Gasketing shall be compatible with astragal design provided by door supplier as required for specific fire door listings.

2.11 THRESHOLDS

A. Acceptable manufacturers and respective catalog numbers:

	Zero	Pemko	NGP	Reese
1. Saddle Thresholds	8655	171	425	S205

B. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to insure a smooth transition between threshold and interior floor finish.

C. Threshold Types:

1. Unless otherwise specified, provide saddle threshold similar to Zero 8655 for all exterior openings with an interior floor finish less than or equal to 1/4" in height.
2. Unless otherwise specified, provide half saddle threshold similar to Zero 1674 for all exterior openings with an interior floor finish greater than 1/4" in height. Threshold height shall match thickness of interior floor finish.

2.12 ELECTRIC STRIKES

A. Acceptable manufacturers and respective catalog numbers:

	Von Duprin	Folger Adams	Hess
1. Type 1	6000 Series	300 Series	9600/8300 Series

B. Provide electric strikes designed for use with the type of locks shown at each opening where specified.

C. Electric strikes shall be UL listed as Burglary-Resistant Electric Door Strikes and where required shall be UL listed as Electric Strike for Fire Doors.

D. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.13 POWER SUPPLIES

A. Provide quantities and types as specified in hardware sets. Shared power supplies will not be accepted without prior approval from the owner.

B. All power supplies shall have the following features:

1. 12/24 VDC Output, field selectable.
2. Class 2 Rated power limited output.
3. Universal 120-240 VAC input.
4. Low voltage DC, regulated and filtered.
5. Polarized connector for distribution boards.
6. Fused primary input.
7. AC input and DC output monitoring circuit w/LED indicators.
8. Cover mounted AC Input indication.
9. Tested and certified to meet UL294.
10. NEMA 1 enclosure.
11. Hinged cover w/lock down screws.
12. High voltage protective cover.

C. All power supplies shall incorporate fused distribution boards.

D. All electro-mechanical systems requiring fail safe circuits shall be capable of interfacing with the fire alarm system to cut power to appropriate system components. Unless already provided in another system component, all power supplies utilized in fail safe circuits shall include an integral relay which when connected to the N/C fire alarm contact will cut power to all openings connected to the individual power supply. Power supply, unless otherwise specified, will automatically reset itself when fire alarm relay returns to normal state following a fire alarm.

2.14 DOOR POSITION SWITCHES

A. Acceptable manufacturers and respective catalog numbers:

	Schlage Electronics	Sentrol	Sargent
1. Concealed (wood & hollow metal doors)	679 Series	1076W	3287

2.15 FINISHES AND BASE MATERIALS

A. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

	HARDWARE ITEM	BHMA FINISH AND BASE MATERIAL
1.	Butt Hinges: Exterior, or Non-Ferrous	630 (US32D - Satin Stainless Steel)
2.	Butt Hinges: Interior	652 (US26D - Satin Chromium)
3.	Exit Devices	626 (US26D - Satin Chromium)
4.	Locks and Latches	626 (US26D - Satin Chromium)
5.	Closers	689 (Powder Coat Aluminum)
6.	Protective Plates	630 (US32D - Satin Stainless Steel)
7.	Overhead Stops	630 (US32D - Satin Stainless Steel)
8.	Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
9.	Thresholds	628 (Mill Aluminum)
10.	Weather-strip, Sweeps Drip Caps	Aluminum Anodized
11.	Miscellaneous	626 (US26D - Satin Chromium)

2.16 KEYING

A. Acceptable manufacturers and respective catalog numbers:

	Schlage	Sargent	Corbin
1.	Everest	Signature	Pyramid

B. Provide all locks and cylinders utilizing a patented keyway to prevent manufacturing and distribution of aftermarket key blanks by anyone other than factory authorized dealers.

C. All locks under this section shall be keyed as directed by the owner to a new Patented Master Key System.

D. Keying shall be by lock manufacturer where permanent records shall be kept.

E. Furnish a total of 2 keys per cylinder. Actual cut keys to be determined by owner.

F. Master keys and control keys to be delivered by registered mail to the owner. Change keys shall be delivered in a set up key cabinet. Construction keys shall be delivered to the contractor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of hardware, installer shall examine door frame installation to insure frames have been set square and plumb. Installer shall examine doors, door frames, and adjacent wall, floor, and ceiling for conditions, which would adversely affect proper operation and function of door assemblies. Do not proceed with hardware installation until such deficiencies have been corrected.

3.2 INSTALLATION

A. Before hardware installation, general contractor/construction manager shall coordinate a hardware installation seminar with a 1 week notice to all parties involved. The seminar is to be conducted on the installation of hardware, specifically of locksets, closers, exit devices, continuous hinges and overhead stops. Manufacturer's representative of the above products to present seminar. Seminar to be held at the job site and attended by installers of hardware (including low voltage hardware) for aluminum, hollow metal and wood doors. Training to include use of installation manuals, hardware schedule, templates and physical products samples.

B. Install all hardware in accordance with the approved hardware schedule and manufacturers instructions for installation and adjustment.

C. Set units level, plumb and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accord with industry standards.

E. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.

F. Shim doors as required to maintain proper operating clearance between door and frame.

G. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute.

H. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.

I. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.

J. Conceal push and pull bar fasteners where possible. Do not install through bolts through push plates.

K. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label.

L. Apply self-adhesive gasketing on frame stop at head & latch side and on rabbet of frame at hinge side.

M. Install hardware in accordance with supplemental "S" label instructions on all fire rated openings.

N. Install wall stops to contact lever handles or pulls. Do not mount wall stops on casework, or equipment.

O. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.

P. Overhead stops used in conjunction with electrified hold open closers shall be templated and installed to coincide with engagement of closer hold open position.

Q. Install door closers on corridor side of lobby doors, room side of corridor doors, and stair side of stairways.

R. Adjust spring power of door closers to the minimum force required to insure exterior and fire rated doors will consistently close and latch doors under existing conditions. Adjust all other door closers to insure opening force does not to exceed 5 lbs.

S. Adjust "sweep", "latch", & "back check" valves on all door closers to properly control door throughout the opening and closing cycle. Adjust total closing speed as required to comply with all applicable state and local building codes.

T. Install "hardware compatible" (bar stock) type weatherstripping continuously for an uninterrupted seal. Adjust templating for parallel arm door closers, exit devices, etc., as required to accommodate weatherstripping.

U. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.

V. Compress sweep during installation as recommended by sweep manufacturer to facilitate a water resistant seal.

W. Deliver to the owner 1 complete set of installation and adjustment instructions, and tools as furnished with the hardware.

3.3 FIELD QUALITY CONTROL

A. After installation has been completed, the hardware supplier and manufacturers representative for locksets, door closers, exit devices, and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware supplier shall submit a list of all hardware that has not been installed correctly.

B. After installation has been completed, the hardware supplier and manufacturers representative shall meet with the owner to explain the functions, uses, adjustment, and maintenance of each item of hardware. Hardware supplier shall provide the owner with a copy of all wiring diagrams. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.

3.4 ADJUSTMENT AND CLEANING

A. At final completion, and when H.V.A.C. equipment is in operation, installer shall make final adjustments to and verify proper operation of all door closers and other items of hardware. Lubricate moving parts with type lubrication recommended by the manufacturer.

B. All hardware shall be left clean and in good operation. Hardware found to be disfigured, defective, or inoperative shall be repaired or replaced.

3.5 HARDWARE SCHEDULE

A. The following schedule of hardware groups are intended to describe opening function. The hardware supplier is cautioned to refer to the preamble of this specification for a complete description of all materials and services to be furnished under this section.

HARDWARE SET #01 – 3, 4, 5, 20, 21

3 – 5BB1 4.5 X 4.5 HINGE	652	IVE
1 – ND50 OFFICE LEVER	626	SCH
1 – 4040XP RW/PA CLOSER	689	LCN
1 – 5050B 17’ SEALS	BRN	NGP
1 – WS407CCV WALL STOP	630	IVE

HARDWARE SET #02 – 6, 9		
3 – 5BB1 4.5 X 4.5 HINGE	652	IVE
1 – ND70RD RHO CLASSROOM LEVER	626	SCH
1 – 4040XP RW/PA CLOSER	689	LCN
1 – 8400 10” X 34” KICKPLATE	630	IVE
1 – 5050B 17’ SEALS	BRN	NGP
1 – WS407CCV WALL STOP	630	IVE
HARDWARE SET #03 – 7, 8, 10, 16, 17		
3 – 5BB1 4.5 X 4.5 HINGE	652	IVE
1 – ND70RD RHO CLASSROOM LEVER	626	SCH
1 – 4040XP RW/PA CLOSER	689	LCN
1 – 8400 10” X 34” KICKPLATE	630	IVE
1 – 5050B 17’ SEALS	BRN	NGP
1 – 904S OVERHEAD STOP	630	GLY
HARDWARE SET #04 – 11, 12		
3 – 5BB1 4.5 X 4.5 HINGE	652	IVE
1 – ND80RD RHO STOREROOM LEVER	626	SCH
1 – 4040XP RW/PA CLOSER	689	LCN
1 – 904S OVERHEAD STOP	630	GLY
1 – 5050B 17’ SEALS	BRN	NGP
HARDWARE SET #05 – 18, 19		
3 – 5BB1 4.5 X 4.5 HINGE	652	IVE
1 – ND10s PASSAGE LEVER	626	SCH
1 – 4040XP RW/PA CLOSER	689	LCN
1 – 8400 10” X 34” KICKPLATE	630	IVE
1 – 5050B 17’ SEALS	BRN	NGP
1 – WS407CCV WALL STOP	630	IVE

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows.
   2. Doors.

1.3 DEFINITIONS

A. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

C. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
      a. Specified Design Wind Loads: As indicated.
      b. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
      c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
         1) Load Duration: 60 seconds or less.
      d. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
         1) For monolithic-glass lites heat treated to resist wind loads.
         2) For insulating glass.
      e. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
   1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   2. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
      a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
      b. Solar Heat Gain Coefficient: NFRC 200.
      c. Solar Optical Properties: NFRC 300.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance.

B. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

C. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.

2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in area, provide glazing products that comply with Category II materials, and for lites 9 sq. ft. or less in area, provide glazing products that comply with Category I or II materials.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Glazing Manual."

2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. For uncoated glass, comply with requirements for Condition A.

2. For coated vision glass, comply with requirements for Condition C (other uncoated glass).

3. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

C. Pyrolytic-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide coating applied by pyrolytic deposition process during initial manufacture, and complying with other requirements specified.

D. Wired Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Quality-Q-6; and of form and mesh pattern specified.

E. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.

2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.

3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

4. Sealing System: Dual seal, with primary and secondary sealants as follows:

a. Manufacturer's standard sealants.

5. Spacer Specifications: Manufacturer's standard spacer material and construction.

2.3 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral-Curing Silicone Glazing Sealants:
   a. Available Products:
      1) Dow Corning Corporation; 790.
      2) GE Silicones; SilPruf LM SCS2700.
      3) Tremco; Spectrem 1 (Basic).
   b. Type and Grade: S (single component) and NS (nonsag).
   c. Class: 100/50.
   d. Use Related to Exposure: NT (nontraffic).
   e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

2.4 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.5 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.6 MONOLITHIC WIRED-GLASS UNITS

A. Polished Wired-Glass Units: Form 1 (wired glass, polished both sides), Quality-Q6, Mesh 1 (M1) (Diamond), 6.0 mm thick.

1. Available Manufacturers:
   a. Asahi/AMA Glass Corp.; affiliated with AFG Industries, Inc.
   b. Central Glass Co., Ltd.; distributed by Northwestern Industries Inc.
   c. Pilkington Sales (North America) Ltd.

2.7 INSULATING-GLASS UNITS

A. Passive Solar Low-E Insulating-Glass Units:

1. Available Products:
2. Overall Unit Thickness and Thickness of Each Lite: 25 and 6.0 mm.
3. Interspace Content: Argon.
4. Outdoor Lite: Class 1 (clear) float glass.
   a. Kind FT (fully tempered).
5. Indoor Lite: Class 1 (clear)float glass.
   a. Kind FT (fully tempered).
6. Low-E Coating or Film: Pyrolytic or sputtered on second or third surface or low-e-coated film suspended in the interspace.
7. Visible Light Transmittance: 70 percent minimum.
8. Winter Nighttime U-Factor: 0.35 maximum.
9. Summer Daytime U-Factor: 0.38 maximum.
10. Solar Heat Gain Coefficient: 0.61 maximum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 08 80 00

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Interior gypsum wallboard.
   2. Sound Attenuation Blankets

1.3 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 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 damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Gypsum Board and Related Products:
      a. National Gypsum Company.
      b. United States Gypsum Co.

2.2 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 36.
   1. Type X:
      a. Thickness: 5/8 inch.
      b. Long Edges: Tapered.
      c. Location: As indicated, Where required for fire-resistance-rated assembly, & on Vertical surfaces, unless otherwise indicated.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
   2. Shapes:
      a. Cornerbead: Use at outside corners.
      b. U-Bead: J-shaped; exposed short flange does not receive joint compound; use at exposed panel edges.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

2.6 TEXTURE FINISHES

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Aggregate Finish:

a. United States Gypsum Co.; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).

B. Primer: USG Sheetrock First Coat Primer. Prime prior to application of texture. Primer and application by Painting Contractor as Specified in Section 09912.

C. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.

1. Texture: Match Existing Wall Texture.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling

3.3 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install sound attenuation blankets before 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 to 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 gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Attach gypsum panels to studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Form control and expansion joints with space between edges of adjoining gypsum panels.

I. Cover both faces of stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect 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- to 3/8-inch- wide joints to install sealant.

J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- 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.

K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

1. Space screws a maximum of 12 inches o.c. in the field, 8” o.c. along abutting end joints.

3.4 PANEL APPLICATION METHODS

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, to minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of board.

b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.6 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

1. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.

3.7 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture finish manufacturer's written recommendations.

3.8 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
    a. Installation of 80 percent of lighting fixtures, powered for operation.
    b. Installation, insulation, and leak and pressure testing of water piping systems.
    c. Installation of air-duct systems.
    d. Installation of air devices.
    e. Installation of mechanical system control-air tubing.
    f. Installation of ceiling support framing.

END OF SECTION 09 21 16

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.
B. CAC: Ceiling Attenuation Class.
C. LR: Light Reflectance coefficient.
D. NRC: Noise Reduction Coefficient.

1.4 QUALITY ASSURANCE

A. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
   2. Suspension System: Obtain each type through one source from a single manufacturer.
B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS FOR TYPICAL ACOUSTICAL PANEL CEILING.

A. Products:
   1. Armstrong, Cirrus Profiles, Classic Step, 2’x2’x3/4”, beveled tegular, Class A, white
B. Classification: Provide panels complying with ASTM E 1264 for Type III, mineral base with painted finish; Form 2, water felted; and pattern as follows:
   1. Pattern: As indicated by manufacturer's designation.
C. Color: White.
D. LR: Not less than .84.

E. NRC: Not less than 0.55.
F. CAC: Not less than 35.
G. Edge Detail: Beveled tegular.
H. Thickness: 3/4 inch.
I. Size: 24 by 24 inches.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" in kitchen ceiling.
C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- diameter wire.

2.5 TYPICAL METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILINGS.

A. Products:
B. Wide-Face, Capped, Double-Web,Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 coating designation, with prefinished, cold-rolled, 9/16-inch- wide.
1. Structural Classification: Heavy-duty system.
2. Face Design: Flat, flush.
3. Face Finish: Painted white.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers:
B. 1. Armstrong
C. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
D. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with the following requirements:
1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for alloy and temper 6063-T5.
2. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
3. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
a. Organic Coating: Thermosetting, primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not attach hangers to steel roof deck. Attach hangers to structural members.
6. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

SECTION 09 62 19 – LUXURY VINYL TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Luxury vinyl tile (LVT).

1.3 SUBMITTALS

A. Samples for Initial Selection: (If requested by Architect) For each type of product indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.5 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After post installation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range – 3 colors, selected at a later date.

2.3 LUXURY VINYL TILE

A. Luxury Vinyl Tile (LVT): ASTM F 1700
   1. Tarkett, Inspired Nature, 32 Mil.
   2. Approved equal

B. Fire-Test-Response Characteristics:
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:
   a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
   b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

E. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

F. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
1. Do not install resilient products until they are same temperature as space where they are to be installed.

G. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
1. Lay tiles square with room axis .

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
1. Lay tiles in pattern of colors and sizes indicated.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, non-staining marking device.

F. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:
1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.
   a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
   a. Use commercially available product acceptable to manufacturer.
   b. Coordinate selection of floor polish with Owner's maintenance service.
2. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09 62 19

SECTION 09 65 13 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Resilient wall base and accessories.

1.3 SUBMITTALS

A. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.
   1. Armstrong World Industries, Inc.;.
   2. Azrock Commercial Flooring, DOMCO;.
   3. Roppe Corporation;.
   4. VPI, LLC, Floor Products Division;.

B. Type (Material Requirement): TV (vinyl).

C. Group (Manufacturing Method): I (solid).

D. Style: Cove (with top-set toe).

E. Minimum Thickness: 0.125 inch.

F. Height: 4 inches.

G. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

H. Outside Corners: Job formed.

I. Inside Corners: Job formed.

J. Surface: Smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:
    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
1. Do not install resilient products until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Job-Formed Corners:
1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:
1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.
    a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 09 65 13

SECTION 09 65 16 - RESILIENT FLOOR TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Vinyl composition tile (VCT).

1.3 SUBMITTALS

A. Samples for Initial Selection: (If requested by Architect) For each type of product indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.5 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
   2. Resilient Wall Base: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 VINYL COMPOSITION TILE

A. Vinyl Composition Tile (VCT): ASTM F 1066.
   1. Azrock, Standard Patterns
   2. Armstrong, Standard Excelon
   3. Tarkett, Expressions

B. Class: 2 (through-pattern tile).

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch.

E. Size: 12 by 12 inches.

F. Fire-Test-Response Characteristics:
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   3. Moisture Testing:
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
D. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
E. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
F. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
   1. Do not install resilient products until they are same temperature as space where they are to be installed.
G. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles square with room axis .
B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles in pattern of colors and sizes indicated.
C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
D. Extend tiles into toe spaces, door reveals, closets, and similar openings.
E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
F. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
      a. Do not wash surfaces until after time period recommended by manufacturer.
B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
   1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
      a. Use commercially available product acceptable to manufacturer.
      b. Coordinate selection of floor polish with Owner's maintenance service.
   2. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09 65 16

SECTION 09 68 30 – Walk Off

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes carpet tile and installation.

B. Related Sections include the following:

1. Division 9 Section "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.
2. Division 9 Section "Carpet."

1.3 SUBMITTALS

A. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Standard samples (if requested by Architect).

B. Maintenance Data: For carpet tile to include in maintenance manuals specified in Division 1. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not install carpet tile until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet tile over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tile, install carpet tile before installing these items.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. R.C. Musson 3/8” fluff-cord strip tile.
   a. Color: As selected by Architect from manufacturer’s full range.
   b. Pattern: As selected by Architect from manufacturer’s full range.
2. Futurus 3/8” heavy duty.
   a. Color: As selected by Architect from manufacturer's full range.
   b. Pattern: As selected by Architect from manufacturer’s full range.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and that is recommended by carpet tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Verify that substrates and conditions are satisfactory for carpet tile installation and comply with requirements specified.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.

2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 13, "Carpet Modules (Tiles)."

B. Installation Method: As recommended in writing by carpet tile manufacturer .

C. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

D. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

F. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 15, "Protection of Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 30

SECTION 09 77 00 – SPECIAL WALL SURFACES (FRP PANELS)

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Special wall surfaces, including fiberglass reinforced plastic panels.

1.02 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation

B. ASTM International:

1. ASTM D2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
2. ASTM D5420 Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
3. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Provide fiberglass reinforced plastic (FRP) panels which have been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer's SPEC-DATA™ product sheet, for specified products.

C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures. Indicate location and dimension of joints and fastener attachment.

D. Samples: Submit selection and verification samples for finishes, colors and textures. Submit 2 samples of each type of panel, trim and fastener.

E. Quality Assurance Submittals: Submit the following:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
3. Manufacturer's Instructions: Manufacturer's installation instructions. Submit manufacturer's *Installation Guide #6211*.

F. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer should be experienced in performing work of this section and should have specialized in installation of work similar to that required for this project.

1.06 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirements Sections.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Package sheets on skids or pallets for shipment to project site.

D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Store panels indoors in a dry place at the project site.

E. Handling: Remove foreign matter from face of panel by using a soft bristle brush, avoiding abrasive action.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:

1. Installation shall not begin until building is enclosed, permanent heating and cooling equipment is in operation, and residual moisture from plaster, concrete or terrazzo work has dissipated.
2. During installation, and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
3. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.08 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner

may have under Contract Documents.

1. Warranty Period: [Specify term.] years commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

A. Manufacturer: Kemlite Company, Inc.

1. Contact: Joliet Sales Office, PO Box 2429, Joilet, IL 60434; Telephone: (800) 435-0080, (815) 467-8600; Fax: (815) 467-8666; E-mail: kemlitesales@kemlite.com; Web site: www.glasbord.com.

B. Proprietary Product(s)/System(s): Kemlite Fiberglass Reinforced Plastic (FRP) Panels.

1. Glasbord Panels:
   a. Fire-X (FX), (FM), FSI, PIF, PWI, PWS, PSI or CGI.
   b. Color: Color to be selected by Architect at a later date from manufacturers full range of standard colors.
   c. Size: As indicated on drawings.
   d. Moldings: Provide harmonizing PVC (polyvinyl chloride) moldings. Color to match panel color
   e. Rivets: Provide rivits in areas where there are large fluctuations in temperature and/or humidity, where the substrate is unusually uneven, and in all low temperature or cold storage applications. Refer to *Installation Guide #6211* for rivet pattern and installation instructions. Color of Rivets to match panel color.
2. *Surfaseal* Surface Protection: Provide manufacturer's proprietary *Surfaseal* surface protection for fiberglass reinforced plastic (FRP) panels.
3. Division Bars, Corner Trim: Panel manufacturer's standard length extruded vinyl pieces; longest length possible to eliminate end joints.
4. Fasteners: Noncorrosive drive rivets.

2.02 PRODUCT SUBSTITUTIONS

A. Substitutions: Equal by Nudo, Glasteel, Citadel, Lasco Board, or Sequentia

2.03 ACCESSORIES

A. Adhesive: Provide panel adhesive as recommended by panel manufacturer.

2.04 RELATED MATERIALS

A. Related Materials: Refer to other sections listed in Related Sections paragraph herein for related materials.

2.05 SOURCE QUALITY

A. Source Quality: Obtain fiberglass reinforced plastic (FRP) panels from a single manufacturer. Provide panels and molding only from manufacturer specified to ensure warranty and color harmonization of accessories.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

1. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails are countersunk and joints and cracks are filled flush and smooth with the adjoining surface.
2. Do not begin installation until backup surfaces are in satisfactory condition.

3.03 PREPARATION

A. Surface Preparation: [Specify applicable product preparation requirements.].

3.04 INSTALLATION

A. Fiberglass Reinforced Panel (FRP) Installation:

1. Cut and drill panels with carbide tipped saw blades or drill bits, or cut with snips.
2. Install panels with manufacturer's recommended gap for panel field and corner joints.
3. Predrill fastener holes in panels with 1/8 inch (3.2 mm) oversize.
4. For trowel type and application of adhesive, follow adhesive manufacturer's recommendations.
5. Use products acceptable to panel manufacturer and install FRP system in accordance with panel manufacturer's printed instructions. Comply with panel manufacturer's *Installation Guide #6211*.

B. Site Tolerances: [Specify applicable site tolerances for specified product(s) installation.].

C. Finish Color/Patterns: [Specify installation finishes coordinated with finishes specified in Part 2 Products.].

D. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related materials installation.

3.05 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace products that have been installed and are damaged. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

1. Remove any adhesive or excessive sealant from panel face using solvent or cleaner recommended by panel manufacturer.

3.06 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION 09 77 00

SECTION 09 91 20 - PAINTING (PROFESSIONAL LINE PRODUCTS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
   1. 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 these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, 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 supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

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. Finished mechanical and electrical equipment.
      b. Light fixtures.
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Foundation spaces.
      b. Furred areas.
      c. Ceiling plenums.
   3. Finished metal surfaces include the following:
      a. Anodized aluminum.
      b. Stainless steel.
      c. Copper and copper alloys.
      d. 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 UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:
   1. Division 2 Section "Hot-Mix Asphalt Paving" for traffic-marking paint.
   2. Division 5 Section "Structural Steel" for shop priming structural steel.
   3. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.
   4. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.

E. Alternates: Refer to Division 1 Section "Alternates" for description of Work in this Section affected by alternates.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
   1. Semi-gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Samples for Initial Selection: For each type of finish-coat material indicated.
   1. After color selection, Architect will furnish color chips for surfaces to be coated.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain primers for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to 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.
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. Maintain storage containers 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.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F 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.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
1. Quantity: Furnish Owner with extra paint materials in quantities indicated below:
a. Exterior, Semi-gloss Acrylic Enamel: 1 gal. of each color applied.
b. Interior, Semi-gloss Acrylic Enamel: 1 gal. of each color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Benjamin Moore & Co. (Benjamin Moore).
2. PPG Industries, Inc. (Pittsburgh Paints).
3. Sherwin-Williams Co. (Sherwin-Williams).

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with 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 that are factory formulated and recommended by manufacturer for application indicated. 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: As selected by Architect from manufacturer's full range.

2.3 EXTERIOR PRIMERS

A. Exterior Wood Primer for Acrylic Enamels: Factory-formulated alkyd or latex wood primer for exterior application.
1. Permachink Systems, Inc.; Lifeline Ultra-2 Exterior Wall Stain: Applied at a dry film thickness of not less than 1.8 mils.
2. Permachink Systems, Inc.; Lifeline Advance, Clear Topcoat Gloss Stain: Applied at a dry film thickness of not less than 1.6 mils.

2.4 INTERIOR PRIMERS

A. Interior Gypsum Board Primer Applied Prior to Texturing. (Priming by painting contractor under this section. Texturing by Gypsum Board supplier under Section 09260.)
1. USG Sheetrock First Coat Primer. Applied prior to application of texture

B. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.

2. Pittsburgh Paints; 6-2 Speed-Hide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil.
3. Sherwin-Williams; Prep-Rite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.6 mils.

2.5 EXTERIOR FINISH COATS

A. Exterior Semi-gloss Acrylic Enamel: Factory-formulated semi-gloss waterborne acrylic-latex enamel for exterior application.
1. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170: Applied at a dry film thickness of not less than 1.1 mils.
2. Pittsburgh Paints; 6-900 Series Speed-Hide Exterior House & Trim Semi-Gloss Acrylic Latex Paint: Applied at a dry film thickness of not less than 1.5 mils.
3. Sherwin-Williams; A-100 Latex Gloss A8 Series: Applied at a dry film thickness of not less than 1.3 mils.

2.6 INTERIOR FINISH COATS

A. Interior Semi-gloss Acrylic Enamel: Factory-formulated semi-gloss acrylic-latex enamel for interior application.
1. Benjamin Moore; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276: Applied at a dry film thickness of not less than 1.2 mils.
2. Pittsburgh Paints; 6-500 Series Speed-Hide Interior Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.0 mil.
3. Sherwin-Williams; ProMar 200 Interior Latex Semi-Gloss Enamel B31W200 Series: Applied at a dry film thickness of not less than 1.3 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as 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 Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 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 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 substrates of substances that could impair 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: 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. 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 SSPC's recommendations.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.3 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 paint 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, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before 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, non-specular 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.
9. Sand lightly between each succeeding enamel or varnish coat.

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 film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup 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 that 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, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause 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 type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:
1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:
1. Switchgear.
2. Panelboards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by 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.

I. 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.

J. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
2. Testing agency will perform appropriate tests as required by Owner:
3. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove non-complying paint from Project site, pay for testing, and repaint surfaces previously coated with the non-complying paint. If necessary, Contractor may be required to remove non-complying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

3.8 EXTERIOR STAIN AND NATURAL-FINISH WOODWORK SCHEDULE

A. Stained Woodwork: Provide the following stained finishes over new exterior woodwork:

1. Stain Finish: One coat clear topcoat gloss satin over two coats of interior wood stain. Wipe wood filler before applying stain.
   a. Stain Coat: Lifeline Ultra-2 exterior wood stain.
   b. Second Stain Coat: Lifeline Ultra-2 exterior wood stain.
   c. Finish Coat: Lifeline Advance Clear Topcoat Gloss Stain.

3.9 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Semi-gloss Acrylic-Enamel Finish: Two finish coats over a primer.
   a. Primer: Interior gypsum board primer.
   b. Finish Coats: Interior semi-gloss acrylic enamel.

END OF SECTION 09 91 20

SECTION 10 14 23 - SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Cutout characters. (Interior plastic room signage)

1.3 SUBMITTALS

A. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering, and braille layout.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each sign type through one source from a single manufacturer.

B. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 CUTOUT CHARACTERS

A. Available Manufacturers:

1. Geffdog Designs (Aberdeen, SD)
2. Best Manufacturing Co.
3. Gemini, Incorporated
4. InPro
5. Or approved equal

B. Cutout characters: Cut characters from solid plate of thickness and material indicated. Produce precisely cut characters with square cut, smooth edges. Comply with requirements indicated for finish, style, and size.

1. Handicapped Restroom: Raised Image/Braille plastic signage HC300 ADA system by Best Manufacturing Co or equal by approved manufacturer. Signage to be approximately 9” x 9” and shall be ADA compliance signage.
2. Room Signage: Signage to be approximately 9” x 7” - 3 layer acrylic sign w/ 2” x 6” slide out clear acrylic panel below room name for changing personal name and shall have braille under room name and will be ADA compliant.

2.3 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.3 SIGN SCHEDULE

A. Signage to be as follows: CUTOUT CHARACTERS

102	OFFICE
103	OFFICE
104	RECEPTION
105	OFFICE
107	CLASSROOM
108	OBSERVATION ROOM
109	PATIENT ROOM
110	CLASSROOM
111	STORAGE/FILES
112	CLASSROOM
113	MECHANICAL/JANITOR
115	COMPUTER TESTING
117	WOMENS TOILET* (HANDICAPPED PICTURE SIGN)
118	MENS TOILET* (HANDICAPPED PICTURE SIGN)
119	OFFICE
120	OFFICE
121	STUDENT CENTER

- VERIFY ROOM NUMBERS WITH OWNER.

END OF SECTION 10 14 23

SECTION 10 2 1 13 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes baked-enamel units as follows:
   1. Toilet Enclosures: Overhead braced Floor anchored.
   2. Urinal Screens: Wall hung.

B. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry" for blocking.
   2. Division 10 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.3 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of reinforcements for compartment-mounted grab bars.

1.4 QUALITY ASSURANCE

A. Comply with requirements in CID-A-A-60003, "Partitions, Toilets, Complete."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 METAL UNITS

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. All American Metal Corp.
   2. American Sanitary Partition Corporation.
   3. Bradley Corporation; Mills Partitions.
   4. ASI Global.
   5. Hiny Hiders Solid Plastic.

B. Baked-Enamel Units: Facing sheets and closures fabricated from ASTM A 591/A 591M, 80Z (electrolytically zinc-coated), commercial steel sheet for exposed applications, that is mill phosphatized, and selected for smoothness.
   1. Facing Sheet Thicknesses: Minimum base-metal (uncoated) thicknesses as follows:
      a. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.0329 inch.
      b. Panels: Manufacturer's standard thickness, but not less than 0.0269 inch.
      c. Doors: Manufacturer's standard thickness, but not less than 0.0269 inch.
      d. Integral-Flange, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.0269 inch.
      e. Wedge-Shaped, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.0329 inch.
   2. Finish: Manufacturer's standard pigmented, organic coating, including thermosetting, electrostatically applied, and powder coatings. Provide coating system that complies with coating manufacturer's written instructions for pretreatment, application, baking, and minimum dry film thickness.
      a. Color: One color in each room as selected by Architect from manufacturer's full range of colors.

C. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets are pressure laminated to core material. Units have continuous, interlocking molding strip or lapped and formed edge closures. Exposed surfaces are free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections. Corners are sealed by welding or clips. Exposed welds are ground smooth.
   1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and 1-1/4 inches for pilasters.
   2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
   3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
   4. Urinal-Screen Construction: Matching panels.

D. Pilaster Shoes: Stainless steel, ASTM A 666, Type 302 or 304, not less than 0.0312 inch specified thickness and 3 inches high, finished to match hardware.

E. Brackets (Fittings):
1. Stirrup Type: Ear or U-brackets, chrome-plated, nonferrous, cast zinc alloy (zamac) or clear anodized aluminum.

2.2 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear anodized aluminum.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Doors: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide out-swinging doors with a minimum 32-inch- wide clear opening for compartments indicated to be accessible to people with disabilities.
1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
2. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
1. Maximum Clearances:
a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.
2. Stirrup Brackets: Secure panels to walls and to pilasters with not less than two brackets attached near top and bottom of panel.
a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than two fasteners. Hang doors to align tops of doors with tops of panels and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor, unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Wall-Hung Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doorsto return doors to fully closed position.

END OF SECTION 10 21 13

SECTION 10 28 13 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Public-use washroom accessories.

1.3 SUBMITTALS

A. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated on Drawings.

B. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment, Inc.
   3. Bradley Corporation.

B. Grab Bar – Where this designation is indicated, provide stainless-steel grab bar complying with the following:
   1. Products: ASI No. 3200P (non-slip) or equal by approved manufacturers. Grab bars to have concealed mounting and required anchors, imbedding plate and fasteners to provide an installation meeting ADA requirements. Mounted 34” to center, locate as directed.
   2. Mounting: Flanges with concealed fasteners.
   3. Material: Stainless steel, 0.05 inch thick.
      a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.
   4. Outside Diameter: 1-1/2 inches.
   5. Configuration and Length: As indicated on Drawings.

C. Mirror Unit – Where this designation is indicated, provide mirror unit complying with the following:
   1. Products: ASI No. 0600-A or equal by approved manufacturer. Mounted 40” from finish floor to lowest reflecting surface.
   2. Frame: Stainless steel, fixed.
      a. Corners: Welded and ground smooth.
   3. Size: As indicated on Drawings.

D. Robe Hook – Where this designation is indicated, provide robe hooks complying with the following:
   1. Products: ASI No. 7340-B or equal by approved manufacturer. Mounted 54” to center, unless noted otherwise.

2.3 CUSTODIAL ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment, Inc.

3. Bradley Corporation.

B. Mop and Broom Holder – Where indicated, provide mop strip unit complying with the following:
   1. Products: ASI No. 7340-B or equal by approved manufacturer. Mounted 54" to center, unless noted otherwise.
   2. Length: 36 inches.
   3. Hooks: Three.
   4. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
   5. Material and Finish: Stainless steel, No. 4 finish (satin).
      a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
      b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of 2 keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

PART 4 – SCHEDULE OF ACCESSORIES

Room 113 to have:
36" mop and broom holder

Room 116 to have:
1 paper towel dispenser
1 soap dispenser
Furnished by owner, installed by contractor – 1 soap dispenser, 1 paper towel dispenser

Room 117 to have:
1 mirror (24"x36")
2 robe hooks
1 grab bar – 36" rear of water closet
1 grab bar – 42" to side of water closet
1 grab bar – 18" to side of water closet- vertical
Furnished by owner, installed by contractor – 1 soap dispensers, 2 toilet paper dispensers, 1 paper towel dispenser, 2 sanitary napkin disposals

Rooms 118 each to have:
1 mirror1 (24"x36")
1 robe hook
1 grab bar – 36" rear of water closet
1 grab bar – 42" to side of water closet
1 grab bar – 18" to side of water closet- vertical
Furnished by owner, installed by contractor – 1 soap dispenser, 1 toilet paper dispenser, 1 paper towel dispenser

END OF SECTION 10 28 13

SECTION 10 44 13 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Fire-protection cabinets for the following:
      a. Portable fire extinguishers.

B. Owner-Furnished Material: Fire extinguishers.

C. Related Sections include the following:
   1. Division 7 Section "Through-Penetration Fire-stop Systems" for fire-stopping sealants at fire-rated cabinets.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
   1. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.4 QUALITY ASSURANCE

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   2. Basis-of-Design Product: The design for each product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Wire Glass: ASTM C 1036, Type II, Class 1, Form 1, Quality q8, Mesh m1 (diamond), 6 mm thick.

2.3 FIRE-PROTECTION CABINET- PROVIDE (3) FIRE EXTINGUISHER CABINETS.

A. Manufacturers or Equal:
   1. General Accessory Mfg. Co.
   2. JL Industries, Inc.
   3. Larsen's Manufacturing Company.

B. Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Material: Enameled-steel sheet.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Steel sheet.

G. Door Style: Center glass panel with frame.

H. Door Glazing: Wire glass.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide manufacturer's standard.
   2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

J. Accessories:
   1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
      a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
         1) Location: Applied to cabinet door.

2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: Red.
4) Orientation: Vertical.

K. Finishes:
1. Manufacturer's standard baked-enamel paint for the following:
a. Exterior of cabinet, door, and trim, except for those surfaces indicated to receive another finish.
b. Interior of cabinet and door.
2. Steel: Baked enamel.
a. Color and Texture: As selected by Architect from manufacturer's full range.

2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish fire-protection cabinets after assembly.

C. 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.

2.6 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pre-treating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
1. Fire-Protection Cabinets: 48 inches above finished floor to top of cabinet.

B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semi-recessed fire-protection cabinets.

C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 12 35 50 - PLASTIC-LAMINATE CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Plastic-laminate casework.

B. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry " for wood blocking for anchoring casework.
   2. Division 9 Section "Gypsum Board Assemblies" for reinforcements in metal-framed gypsum board partitions for anchoring casework.
   3. Division 9 Section "Resilient Wall Base and Accessories" for resilient base applied to plastic-laminate casework.

1.3 DEFINITIONS

A. Exposed Portions of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and visible surfaces in open cabinets or behind glass doors.
   1. Ends of cabinets indicated to be installed directly against and completely concealed by walls or other cabinets after installation shall not be considered exposed.

B. Semi-exposed Portions of Casework: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interior faces of doors. Tops of cases 78 inches or more above floor are defined as semi-exposed.

C. Concealed portions of casework include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

1.4 SUBMITTALS

A. Shop Drawings: For plastic-laminate casework. Include plans, elevations, sections, details, and attachments to other work.
   1. Indicate locations of blocking and reinforcements required for installing casework.
   2. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other equipment.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain casework, including countertops, and accessories, through one source from a single manufacturer.

B. Product Designations: Drawings indicate sizes and configurations of casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes, similar door and drawer configurations, and complying with the Specifications may be considered. Refer to Division 1 Section "Product Requirements."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic-laminate casework until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.8 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for support of plastic-laminate casework.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Plastic-Laminate-Faced Casework:
      a. LSI Corporation of America, Inc.
      b. TMI
      c. MFI
      d. Tru-Built
      e. Cabinets Dakotah
      f. Maloney Millwork
      g. Anderson Millwork
      h. Custom Woodwork
      i. Cal-Dak Cabinets

j. Quest Cabinets
k. Cabinets Universal
l. Woodcraft Specialties
m. Timmerman Woodworking
n. Patzer Woodworking
o. Creative Surfaces

2.2 CABINET MATERIALS

A. General:
1. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

B. Exposed Materials:
1. Plastic Laminate: Type VGS.
a. Colors: As selected by Architect from manufacturer's full range.

C. Semi-exposed Materials:
1. Melamine-Faced Particleboard: Particleboard with decorative surface of thermally fused, melamine-impregnated web and complying with LMA SAT-1.
a. Provide melamine-faced particleboard for semi-exposed surfaces, unless otherwise indicated.
b. Colors: As selected by Architect from manufacturer's full range.

D. Concealed Materials:
1. Solid Wood: Any hardwood or softwood species, with no defects affecting strength or utility.
2. Plywood: Hardwood plywood complying with HPVA HP-1.
3. Plastic Laminate: Type BKL.
4. Particleboard: ANSI A208.1, Grade M-2.
5. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
6. Hardboard: AHA A135.4, Class 1 tempered.

2.3 CABINET DESIGN

A. Flush overlay.
B. Countertops: ½ Bullnose @ front edge; Self edge @ backsplash

2.4 CABINET FABRICATION

A. Construction: Provide plastic-laminate-faced casework of the following minimum construction:
1. Bottoms and Ends of Cabinets, Shelves, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch- thick particleboard, plastic-laminate faced on exposed surfaces, melamine faced on semi-exposed surfaces.
2. Backs of Cabinets: 1/2-inch- thick particleboard, plastic-laminate faced on exposed surfaces, melamine faced on semi-exposed surfaces.
3. Drawer Fronts: 3/4-inch- thick particleboard, plastic-laminate faced on exposed surfaces, melamine faced on semi-exposed surfaces.
4. Drawer Sides and Backs: 1/2-inch- thick melamine-faced particleboard, with glued dovetail or multiple-dowel joints.
5. Drawer Bottoms: 1/4-inch- thick melamine-faced particleboard glued and dadoed into front, back, and sides of drawers. Use 1/2-inch- thick material for drawers more than 24 inches in width.
6. Doors 48 Inches or Less in Height: 3/4 inch thick, with particleboard or medium-density fiberboard cores, solid wood stiles and rails, and plastic-laminate faced on exposed surfaces, melamine faced on semi-exposed surfaces.
7. Doors More Than 48 Inches in Height: 1-1/16 inches thick, with honeycomb cores, solid hardwood stiles and rails, and plastic-laminate faced on exposed surfaces, melamine faced on semi-exposed surfaces.
8. Doors More Than 48 Inches in Height: 1-1/8 inches thick, with particleboard cores, plastic-laminate faced on exposed surfaces, melamine faced on semi-exposed surfaces.

B. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinet fronts.

2.5 PLASTIC-LAMINATE COUNTERTOPS

A. High-Pressure Decorative Laminate Grade: HGS.
B. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. Countertops shall be 1 ½" thick with self edge and detached back splash attached with smart clip system.
2. Color: To be selected for Manufacturers Standard Samples
C. Grain Direction: Parallel to cabinet fronts.
D. Edge Treatment: Same as laminate cladding on horizontal surfaces.
E. Core Material: Particleboard.
F. Core Material at Sinks: Particleboard made with exterior glue.
G. Paper Backing: Provide paper backing on underside of countertop substrate.
H. Provide support brackets as shown or required.

2.6 CABINET HARDWARE

A. General: Provide casework manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Hinges: Frameless concealed hinges (European type) complying with BHMA A156.9, Type B01602, 120 degrees of opening, self-closing.

C. Wire Pulls: Solid aluminum, stainless steel, or chrome-plated brass; fastened from back with two screws. For sliding doors, provide stainless-steel pulls. Provide 2 pulls for drawers more than 24 inches in width.

D. Door Catches: Nylon-roller spring catch or dual, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48 inches in height.

E. Drawer Slides: Powder-coated, 3/4-extension except a file drawers which will be full-extensio, self-closing, heavy-duty drawer slides, designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05091, and rated for 100 lbf.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of plastic-laminate casework.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CABINETS

A. Install level, plumb, and true; shim as required, using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Base Cabinets: Adjust top rails and sub-tops within 1/16 inch of a single plane. Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches o.c. Fasten adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.

1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than 2 fasteners per side.

C. Wall Cabinets: Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches o.c. Align similar adjoining doors to a tolerance of 1/16 inch.

D. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

E. Adjust casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 12 35 50

SECTION 12 36 61 SOLID-SURFACE WINDOWSILLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid-surface-material windowsills.

1.3 SUBMITTALS

A. Product Data: For windowsill top materials.

B. Shop Drawings: For windowsills: Show materials, finishes, edge, methods of joining.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Material: 6 inches square.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of windowsills by field measurements before fabrication is complete.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL

A. Configuration: Provide windowsills with the following style:

SOLID-SURFACE WINDOW SILLLS

Window sills shall ½" thick with beveled edge and rounded corners.

a. Color: As selected by Architect from manufacturer's full range.

Fabrication: Fabricate sills in one piece with shop-applied edges unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

6.1 SUPPLIERS

A. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Avonite Surfaces.
b. Formica Corporation.
c. LG Chemical, Ltd.
d. Samsung Chemical USA, Inc.
e. Swan Corporation (The).
f. Transolid, Inc.
g. Wilsonart International.
h. Corian
i. Or approved equal.

2. Type: Provide Standard Type unless Special Purpose Type is indicated.

PART 7 - EXECUTION

7.1 INSTALLATION

A. Install windowsills, level to a tolerance of 1/8 inch in 8 feet.

B. Align adjacent surfaces and, using adhesive in color to match windowsills, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Install to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

END OF SECTION 12 36 61

WPE WEST PLAINS ENGINEERING, INC.

Contract and Bidding Documents, Drawings & Specifications

Date: March 7, 2025

Project: Instructional Building – Sisseton Wahpeton College

Project #: BS24055

Project Location: Agency Village, SD

Engineer: West Plains Engineering, Inc.
☐ Casper, WY
☐ Cedar Rapids, IA
☐ Rapid City, SD
☒ Sioux Falls, SD

Mechanical Engineer: Stuart M. Oster PE9513

	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed professional engineer under the laws of the State of South Dakota Engineer's Name: Stuart M. Oster License No.: 9513 My license renewal date is 5/31/2026 All pages of this document are covered by this seal. Division 22, 23

Electrical Engineer: Jonathan N. Kennedy PE12457

	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed professional engineer under the laws of the State of South Dakota Engineer's Name: Jonathan Kennedy License No.: 12457 My license renewal date is 5/31/2025 All pages of this document are covered by this seal. Division 26, 27, 28

RAPID CITY, SD/POWER
P: (605) 348-7455
F: (605) 348-9445

SIOUX FALLS, SD
ELEC SPECIALTIES
P: (605) 362-3753
F: (605) 362-3759

CASPER, WY
P: (307) 234-9484
F: (307) 234-5494

CEDAR RAPIDS, IA
P: (319) 365-0030
F: (319) 365-4122

SECTION 22 0510 - MINOR PLUMBING DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mechanical demolition.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements, ductwork and piping arrangements are as shown on Drawings.

B. Verify that ductwork, piping and equipment to be removed serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Engineer/Engineer before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect plumbing and ductwork systems in walls, floors, and ceilings which are to be removed.

B. Coordinate utility service outages with utility company.

C. Coordinate service outages with Owner.

D. Provide temporary piping and connections to maintain existing systems in service during construction.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove exposed abandoned piping and ductwork, including abandoned piping and ductwork above accessible ceiling finishes. Cut piping and ductwork flush with walls and floors, and patch surfaces. Firestop where necessary.

C. Extend existing installations using materials and methods as specified.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

END OF SECTION

SECTION 22 0513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.2 RELATED REQUIREMENTS

A. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc. ; 2015.

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; Institute of Electrical and Electronic Engineers ; 2004.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association ; 2006.

D. NFPA 70 - National Electrical Code; National Fire Protection Association ; 2008.

1.4 SUBMITTALS

A. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
   1. Physical dimensions or NEMA frame size.
   2. Bearing Information.
   3. Performance curves for power factor and efficiency at various loads. Data to be obtained per NEMA Std. MG112.53a (IEEE 112 Method "B")
   4. Nameplate data including NEMA nominal efficiency per NEMA MG112.53b.

B. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

C. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Reliance Electric/Rockwell Automation

B. General Electric.

C. TECO-Westinghouse.

D. Baldor.

E. Toshiba.

F. Louis Allis.

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service: Refer to Section 26 27 17 for required electrical characteristics.
   1. 3 phase motors for use on 208V systems shall be rated for 200 volts and 480V systems shall be rated for 460 volts. Motors rated for 220V or 230V are not acceptable.

B. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 40 degrees C environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class unless otherwise indicated, service factor, and motor enclosure type.
   4. Motors shall be suitable for load, duty, voltage, frequency and hazard, for service and location intended.
   5. NEMA classification of motor enclosures shall apply when motor types are specified as open drip proof, splash proof, totally enclosed, etc.
   6. Motors shall have ball or roller type bearings with pressure grease lubrication.
   7. Motors shall be rated for continuous duty and under full load. Maximum rise in temperature shall not exceed 40 deg. C. for open type, 50 deg. C. for drip-proof and splash-proof types and 55 deg. C. for explosion proof and totally enclosed types.
   8. Motors shall be capable of withstanding momentary overloads of 50%, without injurious overheating.
   9. Motors for belt drive shall have adjustable bases.
   10. Motors shall have nameplates giving manufacturer's name, voltage, phase, HZ, HP, RPM, full load current and service factor.
   11. Minimum Service Factor: 1.15.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor , efficiency.

D. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.3 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.

B. Single phase motors for shaft mounted fans and centrifugal pumps: Split phase type.

C. Single phase motors for fans, pumps, blowers, and air compressors: Capacitor start type.

D. Motors located outdoors: Totally enclosed weatherproof epoxy-sealed type.

2.4 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

2.5 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

2.6 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112 Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9 , L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

I. Sound Power Levels: To NEMA MG 1.

J. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

K. Motors less than 5 HP shall have flexible power leads of sufficient length to extend 3 inches minimum beyond the face of the conduit terminal box.

L. Motors 5 HP and larger shall have terminal lugs.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

D. Coordinate all final electrical requirements with Division 26.

E. Motors for direct drive with coupling shall be aligned, coupled, and doweled to base plate in at least two points.

F. The drive unit shall also be doweled in two places.

3.2 STARTING EQUIPMENT AND SYSTEMS

A. Provide manufacturer's field representative to prepare and start equipment.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION

SECTION 22 0519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 10 06 - Plumbing Piping Specialties.

C. Section 22 30 00 - Plumbing Equipment.

1.3 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers ; 2005.

1.4 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

B. Project Record Documents: Record actual locations of components and instrumentation.

1.5 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturer: Ashcraft Duragauge .

B. Other acceptable manufacturers offering equivalent products.
   1. Crosby .
   2. Trerice .
   3. Dwyer.
   4. Miljoco.
   5. Winters Instruments.
   6. Weiss.

C. Gage: ASME B40.1, UL 393 drawn steel case, phosphor bronze bourdon tube, stainless steel movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Cast aluminum with phosphor bronze bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi and kPa.
   5. Range: Typical range shall be 1-1/2 times the normal operating pressure of the fluid being measured unless otherwise specified.
   6. Provide snubbers on gauges located at pumps.

2.2 PRESSURE GAGE TAPPINGS

A. Gage Cock: Ball valve for maximum 150 psi.

2.3 SOLAR POWERED THERMOMETERS

A. Manufacturer: Dwyer .

B. Other acceptable manufacturers offering equivalent products.
   1. Trerice .

2. Miljoco.
3. Winters Instruments.
4. Weiss.

C. Thermometers - Adjustable Angle: 3-digit LCD display with hi-impact ABS plastic houseing.
1. Temperature Range: -50-300
2. Accuracy: 1% of reading or 1deg, whichever is greater.
3. Resolution: 0.1deg between -19.9-199 deg F.
4. Lux Rating: 10lux.
5. Response Time: 10sec.
6. Sensor: Glass passivated thermistor - NTC.

2.4 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.5 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.
1. Plugs shall be complete with gasketed cap and units rated for 1000 PSI.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gages, one gage adapters with 1/8 inch probes, two 1 inch dial thermometers.
1. Pressure gage range: 0 to 160 PSI.
2. Thermometer ranges: -40 deg. F to 160 deg. F and 0 deg. F to 220 deg. F.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

C. Install pressure gages with pulsation dampers. Provide ball valve to isolate each gage. Provide siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

E. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Where thermometers are provided on local panels, duct or pipe mounted thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

G. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 SCHEDULES

A. Pressure Gages, Location and Scale Range:
1. Domestic Water Service, 0 to 100 psi.
2. Inlet and discharge piping to pumps, 0 to 100 psi.

B. Stem Type Thermometers, Location and Scale Range:

1. Water heater discharge piping, 0 to 200 degrees F.

END OF SECTION

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

B. All marking codes shall be in accordance with ANSI standards.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Brady Corp.

B. Champion-America, Inc.

C. Seton Identification Products.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/2 to 1 inch.
   3. Background Color: Black.

B. Description: Laminated three-layer plastic with engraved white letters on black contrasting background color.

2.3 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Tags shall conform to ANSI A13.1.

2.4 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Color code as follows:
   1. Cold water potable: Green with white letters.
   2. Hot/Recirculating Hot water potable: Green with white letters.

2.5 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
   1. Plumbing Main Valves: Green.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Identify valves in main and branch piping with tags. Reference tag to service (CW, SHW, SRHW, etc.)

E. Identify inline pumps with numbered metal tags and corrosion resistant chains.

F. Identify water softener and water heaters with plastic nameplates.

G. Identify control panels and major control components outside panels with plastic nameplates. Key to control schematic in temperature control shop drawings.

H. Identify piping, concealed or exposed, with plastic pipe markers. Identify service and flow direction, Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

I. Locate ceiling tacks to locate major valves (shutoff or manual balancing) above lay-in panel ceilings. Locate in corner of panel closest to equipment. Major service valves include those in service mains that are used to isolate large portions of a system or areas in a building.

END OF SECTION

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2010.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2013.

C. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2010.

F. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.6 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

B. All products shall conform to NFPA 90A and 90B.

C. Pipe insulation shall conform to or exceed minimum thickness stated in ASHRAE/IES 90.1-2004.

D. Cold system insulation shall provide a complete vapor barrier.

2.2 GLASS FIBER

A. Manufacturers:

1. Knauf Insulation: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning

B. Insulation: ASTM C547 and ASTM C 795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' value: ASTM C177, 0.23 at 75 degrees F.
   2. Maximum service temperature: 850 degrees F.
   3. Maximum moisture absorption: less than 5% by weight.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

2.3 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com.
      b. Speed-Line.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 15 mil.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic:
      a. Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, and strainers.
   1. Insulation must be applied and sealed prior to placing systems into operation.

D. Insulated pipes conveying fluids above ambient temperature: Insulate entire system except for flanges and unions at equipment connections.
   1. Insulation must be applied and sealed prior to placing systems into operation.

E. Insulate fittings and joints (elbows, etc) with pre-molded PVC fitting covers with insulation of like material and thickness as adjoining piping.

F. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts or piping on pipe diameters below 1-1/2 inches.
      a. 20 gauge sheet metal for pipes smaller than 4".
      b. Shield length shall be as follows:
         1) 4" diameter and smaller: 9"
      c. Form the shields to bear on the lower 1/3 periphery of the insulated pipe.
   3. Insert location: Between support shield and piping and under the finish jacket.

4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.

H. Bevel all ends of insulation and seal with vapor barrier mastic.

I. Hangers, supports, anchors, etc. that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

K. Insulation of cold surfaces where vapor barrier jackets are used, jackets shall be applied with a continuous, unbroken vapor seal (hangers on outside of insulation jacket).

L. Items concealed within the insulation shall be clearly marked on the outside of the insulation covering.

3.3 SCHEDULES

A. Plumbing Systems:
1. Domestic Hot Water and Hot Water Recirculation:
a. Glass Fiber Insulation:
1) Pipe Size Range: Thru 2 inch.
(a) Thickness: 1 inch.
2. Domestic Cold Water:
a. Glass Fiber Insulation:
1) Pipe Size Range: 1/2 inch and greater.
(a) Thickness: 1 inch.
3. Roof Drainage Above Grade:
a. Glass Fiber Insulation:
1) Pipe Size Range: All sizes.
(a) Thickness: 1 inch.
4. Plumbing Vents Within 10 Feet of the Exterior:
a. Glass Fiber Insulation:
1) Pipe Size Range: All sizes.
(a) Thickness: 1 inch.

END OF SECTION

SECTION 22 1005 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Storm water.
   4. Gas.
   5. Flanges, unions, and couplings.
   6. Pipe hangers and supports.
   7. Manufactured sleeve-seal systems.
   8. Valves.
   9. Balancing Valves - manual.
   10. Check valves.
   11. Strainers.

1.2 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

B. Section 22 07 19 - Plumbing Piping Insulation.

C. Section 31 23 16 - Excavation.

1.3 REFERENCE STANDARDS

A. ASME B31.9 - Building Services Piping; 2014.

B. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2015.

C. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2010.

D. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2002 (Reapproved 2010).

E. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

F. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

G. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

H. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

I. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2015.

J. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2013a.

K. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems; 2011.

L. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing; 2015.

M. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

N. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.

O. AWWA C651 - Disinfecting Water Mains; 2005.

P. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009.

Q. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.

R. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

S. NSF 372 - Drinking Water System Components - Lead Content; 2011.

T. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2013.

1.4 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Project Record Documents: Record actual locations of valves.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

D. Adhesives, primers and Sealants: Provide Low-VOC adhesives and sealants in compliance with Section 016116, VOC Content Restrictions.

1.6 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of South Dakota plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

C. All piping, equipment, valves, and fittings below 2" for use in systems designed for human consumption shall meet the federal lead free requirements outlined in Senate Bill S.3874. Lead free products shall not contain more that 0.2 percent lead when used with respect to solder and flux; and not more that a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.
   1. Exemptions:
      a. Pipes, pipe fittings, or fixtures, including backflow preventers that are used exclusively for non-potable services such as manufacturing, industrial processing, irrigation, outdoor water, or any other uses where the water is not anticipate to be used for human consumption.
      b. Toilets, bidets, urinals, fill valves, flushometer valves, tub fillers, shower valves, service saddles, or water distribution main gate valves that are 2 inches in diameter or larger.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 SANITARY SEWER AND VENT PIPING, BURIED INSIDE OR WITHIN 5 FEET OF BUILDING

A. The following piping systems shall be allowed where permitted by Local Code:

B. Cast Iron Pipe: ASTM A74 service weight, coated inside and out, "no hub".
   1. Fittings: Cast iron.
   2. Joint Seals: Neoprene sealing sleave with type 301 stainless steel shield and screw type clamps.

C. PVC Pipe: Schedule 40 PVC. ASTM D 2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.3 SANITARY SEWER AND VENT PIPING, ABOVE GRADE

A. PLASTIC PIPING IS NOT PERMISSIBLE IN RETURN AIR PLENUM LOCATIONS.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D2665 Schedule 40.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.4 DOMESTIC WATER PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

A. Type K soft temper copper, ASTM B88.
   1. Joints: Not allowed below ground.

2.5 WATER PIPING, BURIED INSIDE, OR, WITHIN 5 FEET OF BUILDING

A. JOINTS WILL NOT BE ALLOWED UNDER FLOOR.

B. Type K soft temper copper, ASTM B88.
   1. Joints: Solder type with "Sil-Fos", or flared type.
   2. Fittings: Wrought copper colder joint, ANSI B16.22, or brass flared fittings, ANSI B16.26.
   3. Casing: Exterior tar coating and cement lining per ANSI/AWWA-A21.4/C104.

C. Piping 3" in size and larger shall be ductile-iron, piping 2" and smaller shall be Type "K" soft drawn copper water tube.

D. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: Ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket with 3/4 inch diameter rods.

2.6 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
   3. Mechanical Press Sealed Fittings: NSF 61, NSF 372, and ASME 16.51 approved or certified, utilizing EPDM, nontoxic, synthethic rubber sealing elements.
      a. Warranty for mechanical press fittings: 50 years from date of installation.
      b. Press Sealed Fitting Manufacturers:
         1) Viega ProPress
         2) Approved Substitutions.

2.7 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. The following piping systems shall be allowed where permitted by Local Code:

B. Cast Iron Pipe: ASTM A74 service weight, coated inside and out, "no hub".
   1. Fittings: Cast iron.
   2. Joint Seals: Neoprene sealing sleave with type 301 stainless steel shield and screw type clamps.

C. PVC Pipe: Schedule 40 PVC. ASTM D 2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.8 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74 service weight, coated inside and out, "no hub".
   1. Fittings: Cast iron.
   2. Joint Seals: Neoprene sealing sleave with type 301 stainless steel shield and screw type clamps.

B. PVC Pipe: Schedule 40 PVC. ASTM D 2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

C. PLASTIC PIPING IS NOT PERMISSIBLE IN RETURN AIR PLENUM LOCATIONS.

2.9 LP GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: NFPA 58, threaded to ASME B31.1.

2.10 LP GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Copper Tube: Listed, ASTM B88, Type K, annealed.
   1. Joints: Not allowed below ground.

2.11 MISCELLANEOUS DRAIN LINES RECEIVING CONDENSATE, ETC.

A. PVC Pipe: ASTM D2665
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.12 FLANGES, UNIONS, AND COUPLINGS

A. All materials shall be acceptable for use with the medium being carried in the piping system.

B. Copper Piping:
   1. All pipe sizes:
      a. Copper, ground joint union.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier. Provide isolation shutoff valves on each side of dielectric connections.

2.13 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - Drain, Waste, and Vent:
   1. Conform to MSS SP-58.
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

9. Copper Pipe Support: Copper ring, adjustable.

B. Plumbing Piping - Water:
1. Conform to MSS SP-58.
2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
7. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
8. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
9. Vertical Support: Steel riser clamp.
10. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
11. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
12. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
13. Copper Pipe Support: Copper ring, adjustable.

2.14 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

2.15 BALL VALVES

A. Manufacturers:
1. Conbraco Industries.
2. Milwaukee Valve Company.
3. Apollo.
4. Watts.

B. Construction, 3 inches and smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.16 BALANCING VALVES - MANUAL

A. Manufacturers:
1. ITT Bell & Gossett
2. Taco, Inc.
3. Armstrong.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain. Suitable for use in domestic water systems.

2.17 SWING CHECK VALVES

A. Manufacturers:
1. Hammond Valve.
2. Nibco, Inc.
3. Milwaukee Valve Company.

B. Up to 2 Inches:

1. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

2.18 GAS PRESSURE REGULATORS

A. Manufacturers:
   1. Maxitrol
   2. Fisher Regulator

B. Connections: Threaded inlet and discharge.

C. Suitable for up to 15 psi inlet pressure.

2.19 PLUG VALVES

A. Manufacturers:
   1. Maxitrol
   2. Fisher Regulator

B. Construction: Forged brass body with threaded inlet and discharge, chrome plated ball with teflon and buna N seat, and anticorrosion treater level handle with set screw.

2.20 STRAINERS:

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com.
   2. ITT Bell & Gossett.
   3. Taco.
   4. Substitutions.

B. Size 2 inch and Under:
   1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size above 2":
   1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

2.21 FIRE STOP SYSTEMS

A. General Purpose Fire Stopping Sealant:
   1. Water based, nonslumping, premixed sealant with intumescent properties, rated for 3 hours per ASTM E 814 and UL 1479.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Pipe sizes shown on the drawings are nominal pipe sizes, not outside diameters.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. ABSOLUTELY NO PVC/ABS PLASTIC PIPING SHALL BE ALLOWED IN A RETURN AIR PLENUM.

C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

D. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to building lines.

E. Install piping to maintain headroom, conserve space, and not interfere with use of space.

F. Group piping whenever practical at common elevations.

G. Provide swing check valve at discharge of circulating pumps.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

J. Provide access where valves and fittings are not exposed. Doors shall be of approved dimensions with frame, brass hinges, handle, locking device and gasket for air tight joint.

K. Establish elevations of buried piping outside the building to ensure not less than 7 ft of cover for water service and 48 inches (1.1 m) for sanitary and storm sewer service.

L. Excavate in accordance with Section 31 23 16.

M. Backfill in accordance with Section 31 23 23.

N. Install valves with stems upright or horizontal, not inverted.

O. Where valves are used in insulated piping, handle extensions shall be provided. Extensions shall be manufacturered as an option for the valve furnished and shall extend the handle a minimum of 1/4" above insulation.

P. Install isolating valves on all items subject to repair or service.
   1. Valves mounted above head height shall be installed with handles on the side of the pipe, with a downward closure motion. Coordinate valve operation with ceiling installation.

Q. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

R. Install water piping to ASME B31.9.

S. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

T. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

U. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

V. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical steel and copper piping at every other floor. Support riser piping independently of connected horizontal piping.
   7. Support vertical cast iron piping at every floor. Support riser piping independently of connected horizontal piping.
   8. Support vertical plastic piping at every floor plus 5'-0" spacing between floors. Support riser piping independently of connected horizontal piping.
   9. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

10. HANGING FROM ONE PIPE TO ANOTHER SHALL BE STRICTLY PROHIBITED.
11. Provide copper plated hangers and supports for copper piping.
12. Support cast iron drainage piping at every joint.
13. Isolate copper piping from bearing on the cross member with an electrically insulating material.
14. Bear hot piping directly on hangers and cold piping on insulation shielded as described in Section 220719.

W. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

X. The right is reserved to authorize minor changes in pipe location to avoid conflicts with other trades at no additional cost to the Owner.

Y. All lines shall be graded where possible to facilitate drainage. Provide drain valves at bottoms of risers.

Z. Where fixtures are supplied from overhead branch lines, branch lines where possible shall connect at bottom of mains and shall pitch down toward fixtures so that branch lines and/or mains may be drained through fixture.

AA. Branch lines shall be connected to top of mains where branches serve only fixtures located on floor above branch lines.

AB. Install chrome plated steel plates (escutcheons) with set screw and concealed hinge at all wall penetrations. Cut plates to fit flush at close spaced piping locations.

AC. Maintain adequate clearance to service tubes, filters, strainers, valves, specialties as well as for the general replacement of pipe sections and parts.
1. Locate sufficient unions and flanges to permit independent removal of equipment.

AD. All gas piping shall be installed with plugged drip pockets at low points.

AE. The entire gas piping installation shall be in accordance with the latest requirements of the AGA and NBFU.

AF. Valves or cocks, pressure regulators, and unions shall be installed on inlet gas pipe to all equipment, including safety valves where required or noted to be installed.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Provide manual balancing valves in water recirculating systems where indicated.

D. Provide plug valves in lp gas systems for shut-off service to equipment.

E. Provide swing check valves on discharge of water pumps

3.5 TOLERANCES

A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum for pipe sizes 3" and smaller. Maintain gradients.

B. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum for pipe sizes 4" and larger. Maintain gradients.

C. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

D. Soil, waste, vent piping and rainwater conductors, etc. shall be tested in accordance with applicable state and local codes.

3.6 PIPE TESTING

A. Test underground pipes, or pipes in chases and walls, before piping is concealed.

B. Test pipes before insulation is applied.
   1. If insulation is applied before pipe is tested and leak(s) occur which ruins insulation, pipe installing contractor arranged and pays for replacing damaged insulation and other damaged building components.

C. Domestic water piping shall be tested and proven water tight under a hydrostatic pressure of 100 PSIG. Pipe shall be tested with water pressure or equal inert gas such as nitrogen.
   1. Hold test pressure for minimum 8 hours.
   2. Test witnessed by Architect/Engineer or representative, if requested by University Construction Manager.

D. Hydrostatically test soil, waste, vent, and storm piping inside of building with 15 feet head of water and allow to stand for one hour for inspection before connecting fixtures. If leaks occur, repair and retest.

E. Water test pressurized soil mains at pressure equal to 1-1/2 times operating pump discharge pressure.

F. Test all other piping systems to a pressure of 150 percent of normal operating pressure and hold for 1 hour without showing a drop in pressure.
   1. Test piping using water, nitrogen or air compatible with the final piping service.

G. LP gas piping shall be tested with an air pressure of not less that 125 PSIG. The system shall hold this pressure for 24 hours without drop.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfection of new systems shall meet all applicable Local Codes in addition to the following:
   1. Provide necessary connections to facilitate disinfection of entire system.
   2. Prior to starting work, verify system is complete, flushed and clean.
      a. Operate flush valves, faucets and other valves as needed until flow is clean.
      b. After flushing, remove inlet strainers, aerators and other devices, thoroughly clean and replace.
      c. Remove valve assemblies to clean out foreign material when necessary and replace assemblies.
   3. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
   4. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
   5. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 30 percent of outlets.
   6. Maintain disinfectant in system for 24 hours.
   7. If final disinfectant residual tests less than 25 mg/L, repeat treatment until piping meets state and local bacteriological tests and is approved.
   8. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
   9. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.8 SERVICE CONNECTIONS

A. Connect to existing sanitary sewer service. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Connect to new storm sewer service. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

C. Provide new water service complete with approved RPZ backflow preventer with by-pass valves as indicated on the drawings.
   1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
   2. Provide 18 gage, 0.0478 inch galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

3.9 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches to 1-1/4 inches:
         1) Maximum Hanger Spacing: 6 ft.
         2) Hanger Rod Diameter: 3/8 inches.
      b. Pipe Size: 1-1/2 inches to 2 inches:
         1) Maximum Hanger Spacing: 6 ft.
         2) Hanger rod diameter: 1/2 inch.
      c. Pipe Size: 2-1/2 inches to 3 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 1/2 inch.
      d. Pipe Size: 4 inches to 6 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 5/8 inch.
      e. Pipe Size: 8 inches to 12 inches:
         1) Maximum hanger spacing: 14 ft.
         2) Hanger Rod Diameter: 7/8 inch.
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum Hanger Spacing: 6 ft.
         2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION

SECTION 22 1006 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Floor drains.

B. Cleanouts.

C. Hydrants.

D. Backflow preventers.

E. Water hammer arrestors.

F. Roof drains.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 40 00 - Plumbing Fixtures.

C. Section 22 30 00 - Plumbing Equipment.

1.3 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001 (R2007).

B. ASME A112.26.1M - Water Hammer Arrestors; The American Society of Mechanical Engineers; 1984.

C. PDI-WH 201 - Water Hammer Arresters; Plumbing and Drainage Institute; 2010.

D. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1011).

E. ASME A112.21.2M - Roof Drains; The American Society of Mechanical Engineers; 1983.

F. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers; American Society of Sanitary Engineering; 2011.

G. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering; 2011 (ANSI/ASSE 1019).

1.4 SUBMITTALS

A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

1.6 REGULATORY REQUIREMENTS

A. All piping, equipment, valves, and fittings below 2" for use in systems designed for human consumption shall meet the federal lead free requirements outlined in Senate Bill S.3874. Lead free products shall not contain more that 0.2 percent lead when used with respect to solder and flux; and not more that a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

1. Exemptions:

a. Pipes, pipe fittings, or fixtures, including backflow preventers that are used exclusively for non-potable services such as manufacturing, industrial processing, irrigation, outdoor water, or any other uses where the water is not anticipated to be used for human consumption.

B. Toilets, bidets, urinals, fill valves, service saddles, or water distribution main gate valves that are 2 inches in diameter or larger.

PART 2 PRODUCTS

2.1 DRAINS

A. Floor Drains in floors at or above grade (Toilet Rooms):
   1. Manufacturers:
      a. Zurn Model ZN-415S
      b. Josam.
      c. Smith.
   2. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
   3. Provide inside caulk outlet cast iron floor drain with a 5”x5” type “S” strainer. Connect outlet of drain to "P" trap.

B. Floor Drains in floors at or above grade (Mechanical Rooms Only)
   1. Manufacturers:
      a. Zurn Model ZN-415N.
      b. Josam.
      c. Smith.
   2. ASME A112.21.1M; lacquered cast iron two piece body with double drainage flange, 9" nickel bronze type "N" strainer, weep holes, membrane clamp, reversible clamping collar, and round, adjustable nickel-bronze strainer.
   3. Connect outlet of drain to a cast iron deep seal (4" minimum) "P" trap.
   4. For floor drains installed in second floor mechanical rooms above occupied spaces, plumbing contractor shall install rubber membrane for minimum 24" from floor drain in all directions and concrete floor is being poured. Clamp drain to rubber membrane with membrane clamp. Continue pouring flooor and adjust strainer height flush with top of finished floor.

C. Primary Roof Drains:
   1. Manufacturer: Zurn Model ZC-100-C-R.
   2. Other acceptable manufacturers offering equivalent products:
      a. JR SMITH.
      b. Wade.
      c. Josam.
      d. Watts Drainage Products.
   3. Assembly: ASME A112.21.2M.
   4. Body: Lacquered cast iron with sump.
   5. Strainer: Removable cast iron dome.
   6. Accessories: Coordinate with roofing type:
      a. Adjustable under deck clamp.
      b. Roof sump receiver.

2.2 CLEANOUTS

A. Cleanouts:
   1. Manufacturers:
      a. Josam Model ZN1400-T
      b. Smith.
   2. Lacquered cast iron body with anchor flange, reversible clamping collar, square 5”x5” top assembly for 2" vertical adjustment, gasketed scored cover in service areas and gasketed depressed cover to accept floor finish in finished floor areas.
   3. Cleanouts shall be full line size through 4" pipe.
   4. Covers shall be nickel bronze square frame and cover, deep flange tractor type, extra heavy duty type in heavy traffic areas.

B. Cleanouts at Interior Finished Wall Areas:

1. Manufacturers:
    a. Josam
    b. Zurn.
    c. Smith.
2. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

2.3 HYDRANTS

A. Exterior Wall Hydrants:
1. Manufacturers:
    a. Woodford.
    b. Josam.
    c. Watts.
    d. Zurn.
2. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate hose thread spout, lock shield and removable key, and integral vacuum breaker.
3. Valve shall be located on the inside of the wall.
4. Finish: Brushed 304 stainless steel.
5. Supplies: 3/4 inch NPT connection.

B. Exterior Roof Hydrants:
1. Manufacturers:
    a. Woodford.
    b. Josam.
    c. Watts.
    d. Zurn.
2. ASSE 1057; freeze resistant, self-draining type with integral ASSE 1052 dual check backflow preventer, integral air vent.
3. Provide with roof mounting system including cast iron hydrant support and under deck clamp, and EPDM rubber boot.
4. Supplies: 3/4 inch NPT connection.

2.4 BACKFLOW PREVENTORS

A. Manufacturers:
1. Conbraco Industries.
2. Wilkins.
3. Watts.

B. Reduced Pressure Backflow Preventers:
1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.
2. Provide with air gap funnel fitting for connection from water outlet similar to Watts 909AG series, brass.

2.5 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company
2. Wade.
3. Josam.
4. Sioux Chief.
5. Zurn Industries, Inc

B. Water Hammer Arrestors:
   1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

2.6 ROOF JACKET

A. Manufacturer:
   1. Moore Model #1-S or #1-F.

B. Constructed with a roof flange of 16 ounce copper or 4 pound per square foot lead pan, suitable for roofing applications.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Fasten wall hanging plumbing specialties securely to support attached to existing building substrates.

D. Install individual shutoff valves in each water supply connection to plumbing specialties. Use ball valves if specific valve is not indicated. Install valves in accessible locations.

E. Install floor cleanouts at elevation to accommodate finished floor.

F. At plumbing chase locations, sanitary sewer piping installation shall be laid out to provide long sweep fittings to locate cleanouts within the chase and 6 inches above the highest drained fixture overflow level.

G. Install reduced pressure zone backflow preventer on new domestic cold water service in mechanical room.

H. Install water hammer arrestors complete with accessible isolation valve on cold water supply piping to bathroom groups.

I. Install escutcheons at wall and ceiling penetrations in exposed finished location and within cabinets and millwork. Use deep pattern escutcheons if required to conceal protruding pipe fittings.

J. CLEANOUTS MUST BE PROVIDED IN ACCORDANCE WITH THE LOCAL CODE AND AS SHOWN ON THE DRAWINGS.

K. Encase exterior cleanouts in concrete flush with grade.

L. Roof extension from soil, waste and vent pipes shall be extended at least 18 inches above the roof, and must be encased in frost proof jackets, each having an air space at least 1" between the outside surface of the pipe and a cap over the top of the pipe so that it will be unnecessary otherwise to plug the inside of the vent pipes at the top when the test is made.
   1. These plugs must be of a type readily seen until removed.
   2. Remove the plugs at once after the piping system has been tested.

M. Confirm that millwork is constructed with adequate provision for the installation of trim to be provided by the Plumbing Contractor.

3.2 DEMONSTRATION

A. Train Owner's directed personnel to adjust, operate, and maintain equipment.
   1. Train Owner's maintenance personnel on procedures for starting and stopping equipment, troubleshooting, routine servicing and maintenance.
   2. Review data complete in Operations and Maintenance manual.

END OF SECTION

SECTION 22 3000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water heaters.

B. Diaphragm Type compression tanks.

C. Water softeners.

D. Pumps.
   1. Inline recirculating pumps.

1.2 RELATED REQUIREMENTS

A. Section 262717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2010.

B. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

C. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data:
   1. Provide dimension drawings of hot water storage tanks indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

B. Shop Drawings:
   1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

B. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.6 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.

C. Water Tanks: ASME labeled, to ASME (BPV VIII, 1).

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

A. Provide two year manufacturer warranty for in-line circulator.

B. Provide three year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.1 COMMERCIAL ELECTRIC WATER HEATERS

A. Manufacturers:
   1. Rheem/Ruud.
   2. AO Smith.
   3. Substitutes.

B. Type: Factory-assembled and wired, electric, vertical storage.

C. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.

D. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.

E. Accessories: Provide:
   1. Water connections: Brass.
   2. Dip tube.
   3. Drain Valve.
   4. Anode: Magnesium.
   5. Temperature and Pressure Relief Valve: ASME labelled.

F. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 Watts per square inch.

2.2 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:
   1. Armstrong.
   2. ITT Bell and Gossett.
   3. Amtrol.
   4. Taco.
   5. Substitutes.

B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible heavy duty butly rubber diaphragm sealed into tank, and steel legs or saddles.

C. Connections: System connection (top), tank drain (bottom), charging valve (top).

D. Tank precharge pressure shall be factory standard 40 psi.

2.3 WATER SOFTENERS

A. Manufacturers:
   1. Culligan.
   2. Water Control.
   3. Substitutes.

B. Controls: Programmable with back lit LCD display. 24 volt. Provide with 120V to 24V plug in transformer. Controls shall have battery backup.

C. Controls shall have an auxiliary output that activates or deactivates when the regeneration process is initiated.

D. Provide with flow meter (to be field installed) to start regeneration cycle after preset volume of water has been softened.

E. Provide with corrosion resistant brine and resin tanks constructed from fiberglass reinforced polyester.

F. Provide with positive motor driven regeneration control valve.

G. Provide a complete fill of salt in tank after system startup.

2.4 IN-LINE CIRCULATOR PUMPS (DOMESTIC HOT WATER)

A. Manufacturers:
   1. Armstrong Pumps Inc: www.armstrongpumps.com.
   2. ITT Bell & Gossett: www.bellgossett.com.
   3. Taco.
   4. Substitutes.

B. Casing: Bronze, rated for 125 psig working pressure.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related electrical work to achieve operating system.

C. Install ball valve with threaded connection on tank drains.

D. Install isolation ball valves at connections to hot water heater and water softener.

E. Install flow meter shipped loose with water softener. Install on cold water piping at location in accordance with manufacturer's guidelines.

F. PIpe full size from T&P relief valve on water heater to nearest floor drain or mop sink.

G. Install thermometer on hot water discharge piping from hot water heater tank.

H. Pumps:
   1. Provide line sized isolating valve and strainer on suction and line sized swing check valve and balancing valve on discharge.
   2. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
   3. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
   4. Starters and wiring shall be provided under Division 26, Electrical.

3.2 STARTING EQUIPMENT AND SYSTEMS

A. Provide manufacturer's field representative to prepare and start equipment.

B. Adjust for proper operation within manufacturer's published tolerances.

C. The water softener's factory trained representative shall be employed for startup of water softener and to make final connection of piping and controls between the brine and resin tanks.

D. Adjust water heater discharge water temperature to 140 degrees F.

3.3 DEMONSTRATION

A. Train Owner's directed personnel to adjust, operate, and maintain equipment.
   1. Train Owner's maintenance personnel on procedures for starting and stopping equipment, troubleshooting, routine servicing and maintenance.
   2. Review data complete in Operations and Maintenance manual.

END OF SECTION

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Service sinks.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 10 06 - Plumbing Piping Specialties.

C. Section 22 30 00 - Plumbing Equipment.

1.3 REFERENCE STANDARDS

A. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997 (Reaffirmed 2002).

B. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2012.

C. ASME A112.19.2 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2008.

1.4 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Manufacturer's Instructions: Indicate installation methods and procedures.

C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 PRODUCTS

2.1 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, china bolt caps.
   1. Flush Volume: 1.28 gallon, maximum.
   2. Maximum Performance (MaP): 800 grams per single flush, minimum rating.
   3. Flush Valve: Exposed (top spud).
   4. Flush Operation: Sensor operated, battery powered.
   5. Manufacturers:
      a. American Standard Inc: www.americanstandard.com.
      b. Kohler Company: www.kohler.com.
      c. Zurn Industries, Inc: www.zurn.com.
      d. Sloan.
   6. Mounting Heights:
      a. Handicapped: 18" AFF to top of seat.

B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   1. Sensor-Operated Type: Solenoid operator, battery powered, infrared sensor and over-ride push button.
   2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.

3. Flush valve shall be flow-matched to china fixture.
4. Manufacturers:
    a. Sloan Valve Company: www.sloanvalve.com.
    b. Zurn Industries, Inc: www.zurn.com.

C. Seats:
1. Manufacturers:
    a. Bemis Manufacturing Company: www.bemismfg.com.
    b. Church Seat Company: www.churchseats.com.
    c. Olsonite: www.olsonite.com.
2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

D. Water Closet Carriers:
1. Manufacturers:
    a. JOSAM Company: www.josam.com.
    b. Sloan Valve Company.
    c. Zurn Industries, Inc: www.zurn.com.
    d. Wade.
2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers. Horizontal drain and vertical vent connections.

2.2 WALL HUNG URINALS

A. Wall Hung Urinal Manufacturers:
1. American Standard Inc
2. Kohler Company:
3. Zurn Industries.

B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Flush Volume: 0.5 gallon, maximum.
2. Flush Style: Washout.
3. Flush Valve: Exposed (top spud).
4. Flush Operation: Sensor operated.
5. Trap: Integral.
6. Mounting Heights:
    a. Handicapped: 17" AFF to rim.
    b. Non-Handicapped: 24" AFF to rim.

C. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
1. Sensor-Operated Type: Solenoid operator, battery powered, infrared sensor and over-ride push button.
2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
3. Manufacturers:
    a. Sloan Valve Company: www.sloanvalve.com.
    b. Zurn Industries, Inc: www.zurn.com.

D. Carriers:
1. Manufacturers:
    a. JOSAM Company: www.josam.com.
    b. Sloan Valve Company.
    c. Zurn Industries, Inc: www.zurn.com.
    d. Wade.
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.3 LAVATORIES

A. Lavatory and Faucet Manufacturers:
   1. American Standard Inc: www.americanstandard.com.
   2. Kohler Company: www.kohler.com.
   3. Zurn Industries, Inc: www.zurn.com.
   4. Sloan.

B. Vitreous China Wall Hung Basin:
   1. ASME A112.19.2; vitreous china wall hung lavatory 18 x 20 inch minimum, with 4 inch high back, rectangular basin with front overflow, side splash shields, and faucet ledge.
      a. Drilling Centers: 4 inch.
      b. Supplies: 3/8" angle supplies flexible tubing risers with chrome finish.
      c. Trap: 1-1/4 inch adjustable cast brass "P" trap with cleanout.
      d. Trap Guard: Truebro Lav Guard.
      e. Faucet: Chrome plated cast brass spout with sensor module, spout module, inline filter, and 0.5 gpm laminar flow outlet.
         1) Provide faucets with a hard wire power transformer and plug in for wall outlet.
      f. Provide ASSE 1070 rated point of use thermostatic mixing valve for each faucet.

C. Accessories:
   1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
   2. Offset waste with perforated open strainer.
   3. Loose key stops.
   4. Carrier (wall hung only):
      a. Manufacturers:
         1) JOSAM Company: www.josam.com.
         2) Sloan Valve Company.
         3) Zurn Industries, Inc: www.zurn.com.
      b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

2.4 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:
   1. Tri Palm International/Oasis: www.tripalmint.com.
   2. Elkay Manufacturing Company: www.elkay.com.
   3. Halsey Taylor.
   4. Haws Corporation: www.hawsco.com.

B. Electric Water Cooler:
   1. Description: Dual height, wall mounted and self-contained water cooler with automatic sensor bottle filler.
   2. No lead design: Water cooler shall be certified to be lead free as defined by the Safe Drinking Water Act. Water cooler shall be manufactured with a waterway system utilizing copper components and completely lead free materials. All joints shall be brazed using silver solder only.
   3. Compressor: Hermetically sealed, reciprocating type. Equipped with electric cord and three prong molded rubber plug. Refrigerant shall be HFC-134a.
   4. Condenser: Fan cooled, copper tube with aluminum fins. Fan motor shall be permanently lubricated.
   5. Temperature control: Enclosed adjustable thermostat.
   6. Basin: Type 304 stainless steel, on piece polished finish.
   7. Cabinet Color: Two tone gray upper shroud with textured gray lower shroud.

C. Accessories:
   1. Flexible supplies.

2. Loose key stops.
3. Chrome plated 17 gage brass P-trap.
4. "Lead Free" material certification from manufacturer.
5. Apron.

2.5 SERVICE SINKS

A. Bowl:
1. Manufacturers:
a. Swan.
b. Mustee.
c. Zurn.
d. Fiat.
2. 24 x 24 x 10 inch high white molded stone, floor mounted, with one inch wide shoulders, vinyl bumper guard, stainless steel strainer, mop hanger, hose hanger and hose, and stainless steel wall guards.

B. Trim:
1. Manufacturers:
a. Fiat.
b. T&S Brass.
c. Chicago.
d. Zurn
e. Delta
2. ASME A112.18.1M exposed wall type supply with lever handles, spout wall brace, vacuum breaker, hose end threaded spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.
a. Pail hook integral to faucet spout.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
1. Escutcheons shall cover entire pipe penetration through wall at fixture connection.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall carriers and bolts.

E. All fixtures fitted to the walls or floor shall be ground and true and be sealed with a non-hardening white silicone caulk bead.

F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

G. Exposed flush, waste and supply pipes at the fixtures shall be chromium plated brass pipe, iron pipe size. Fittings for brass pipe shall be cast brass, chromium plated.

H. Install chromium plated wall or floor plates (escutcheons) with set screw and concealed hinge where pipe passes through walls or floors.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B. Coordinate wiring of sensor faucets with Division 26, Electrical.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 0510 - MINOR HVAC DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mechanical demolition.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements, ductwork and piping arrangements are as shown on Drawings.

B. Demolition drawings are based on casual field observation and existing record documents.

C. Report discrepancies to Engineer before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Coordinate service outages with owner.

B. Provide temporary piping and connections to maintain existing systems in service during construction.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove exposed abandoned piping and ductwork, including abandoned piping and ductwork above accessible ceiling finishes unless noted otherwise on the plans. Cut piping and ductwork flush with walls and floors, and patch surfaces. Firestop where necessary.

C. Repair adjacent construction and finishes damaged during demolition and extension work.

D. Maintain access to existing mechanical installations which remain active. Modify installation or provide access panel as appropriate.

E. Extend existing installations using materials and methods as specified.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

END OF SECTION

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

1.2 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Product Data: Provide manufacturers catalog literature for each product required.

C. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc: www.Champion-America.com.

C. Seton Identification Products: www.seton.com/aec.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: Black.
   2. Letter Height: 1/2 inch.
   3. Background Color: While.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Identify rooftop units, fans, air terminal units, and unit heaters with plastic nameplates.
   1. Nameplates shall be approximatley 5" x 2-1/2" in size.
   2. Minimum information to be noted shall include:
      a. Equipment tag - 1/2" letters. (ex. AHU-1)

C. Identify control panels and major control components outside panels with plastic nameplates.
   1. Minimum information to be noted shall include:
      a. Equipment tag - 1/2" letters. (ex. AHU-1)

D. Tag automatic controls, instruments, and relays. Key to control schematic.

E. Identify space temperature, humidity, and pressure sensors with plastic nameplates.

F. Identify major control components above ceilings by marking the ceiling grid or assembly with adhesive tags and black lettering, size 16 font, referencing the equipment ID on the tag.

END OF SECTION

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

1.2 RELATED REQUIREMENTS

A. Section 23 3300 - Air Duct Accessories _ Duct test holes and volume control dampers.

B. Section 23 0993 - HVAC Sequences of Operation - Coordination with Temperature Controls Contractor on motorized damper set points.

1.3 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2008.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

1.4 SUBMITTALS

A. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
   3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.
   4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   6. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.
   7. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, NEBB forms, or forms containing information indicated in Schedules.
   8. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Engineer.
      g. Project Contractor.
      h. Report date.

C. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 - PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Testing and Balancing Agency shall be a subcontractor to the General Contractor.
   1. The Testing and Balancing Agency shall not be an employee of the Mechanical Contractor or it's subsidiaries.

B. Perform total system balance in accordance with one of the following:
   1. AABC MN-1, AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. SMACNA HVAC Systems Testing, Adjusting, and Balancing.

C. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
   1. If requested, conduct balancing activities in presence of Owner.
   2. Do not begin balancing activities until system(s) have been substantially completed and are in good working order to permit preliminary measurements of total air or water volumes and system pressures.
   3. Proceed with final balancing and adjustments when systems are 95 to 100 percent complete.

D. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

E. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

F. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

G. Completely coordinate with work of all other trades.

H. Testing and Balancing Agency shall furnish all labor, materials, tools, equipment, and services to test, balance and adjust all mechanical systems as indicated, in accordance with provisions of Contract Documents.

3.2 REPSPONIBILITIES OF TESTING AND BALANCING AGENCY

A. Accurately calibrate and maintain all test instruments in good working order.
   1. If requested, conduct tests of instruments in the presence of the Owner's Representative.

B. Check component parts of complete system for their independent functions and composite operation in the system so that all capacities and requirements as shown on drawings and outlined in specifications have been met.

C. Inspect the installation and operation of the mechanical sheet metal work, temperature controls and other components of the HVAC systems as relates to proper arrangement and adequate provisions for testing and balancing.

D. Schedule work with trades involved.

E. Check, adjust and balance system components to obtain optimum conditions in each conditioned space.

F. Record all inspections, tests and adjustments.

G. Prepare and submit reports of all tests.

3.3 RESPONSIBILITIES OF INSTALLING CONTRACTOR

A. Startup all systems and keep in correct operation during balancing operations.

B. Assign personnel as required to make necessary adjustments and corrections to balance systems.

C. Maintain accessibility to test locations and devices requiring adjustment.

D. Allow adequate time in project schedule for completion of TAB Activity prior to substantial completion.

3.4 JOB CONDITIONS

A. Perform work at time as agreed upon by Installing Contractor and Owner.
   1. If work is not done during peak cooling season, demonstrate satisfactory balancing during next peak cooling season.

3.5 CORRECTIVE WORK

A. Provide extended warranty of 90 days, after completion of test and balance work, during which time the Owner may, at their discretion, request recheck or resetting of any equipment or system which is not performing satisfactorily.
   1. Provide technicians to assist as required in making such tests.

3.6 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
      a. Thermostats shall be connected and will operate the air terminal units for both heating and cooling. If thermostats are not connected, arrange with Temperature Controls Contractor to place all terminal units in full cooling position.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Air coil fins are cleaned and combed.
   8. Access doors are closed and duct end caps are in place.
   9. Air outlets are installed and connected.
   10. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Advise A/E and General Contractor of necessary adjustments and corrective measures.

D. Beginning of work means acceptance of existing conditions.

3.7 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.8 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.9 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Balance system utilizing the 'proportional' method.

C. Balance each air system that is served by air filters, using artificial static loading of system, to demonstrate, test and obtain system design pressure drop.
   1. Provide dirty filter pressure drop conditions on system. Approximate 60% of peak pressure drop value.
   2. Do not use high efficiency filters (75% and above) in testing and balancing.
   3. Static pressure losses may be simulated by using sheet steel blanking plates in high efficiency filter racks and housings.
   4. Do not install blanking plates within 2 ft. of any low efficiency filter unit or rack

D. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

E. Measure air quantities at air inlets and outlets.
   1. Identify location and area of each grille, diffuser and register.
   2. Identify and list size and type of diffusers, grilles and registers.
   3. Use manufacturer's ratings on all equipment to make required calculations.
   4. Adjust to minimize drafts.

F. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

G. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

H. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

I. Where modulating dampers are provided, take measurements and balance at extreme conditions.

J. Variable air volume equipment with integral OA dampers:
   1. The outside air damper on the equipment will operate automatically through the BAS to maintain minimum OA volume (with field installed airflow measuring station in unit) or larger volumes required for economizer operation. The TAB Contractor will not be responsible for setting of any OA damper positions during balancing, however, shall assist the Temperature Controls Contractor in setting minimum OA volumes.

K. After all terminal units and exhaust and return air systems are balanced, take a second set of CFM and static pressure readings at suction and discharge of each supply, return and exhaust fan.
   1. Notify A/E and Owner if air quantities are not within the specified tolerances.
   2. Installing Contractor and/or equipment supplier shall be notified to facilitate adjustment or replacement of the fan drives or unit to obtain proper fan air quantities

3.10 SCOPE

A. Test, adjust, and balance the following:
   1. Packaged Rooftop Units
   2. Air Coils

3. Power HVAC Ventilators
4. Cabinet Unit Heaters
5. Unit Heaters
6. Plumbing Pumps
7. Air Inlets and Outlets
8. Domestic Hot Water Recirculating Valves
9. Air terminal units

3.11 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer
2. Model/Frame
3. HP/BHP
4. Phase, voltage, amperage; nameplate, actual, no load
5. Service factor
6. Actual nameplate efficiency
7. Starter size, rating, heater elements
8. Sheave Make/Size/Bore

B. Plumbing Pumps:
1. Identification/number
2. Manufacturer
3. Size/model
4. Service
5. Design flow rate, pressure drop
6. Actual flow rate, pressure drop
7. Discharge pressure
8. Suction pressure
9. Total operating head pressure

C. Cabinet Unit and Unit Heaters:
1. Identification/number
2. Location
3. Service
4. Manufacturer
5. KW input.

D. Packaged Rooftop Units:
1. Manufacturer
2. Model number
3. Serial number
4. Supply fan airflow, design and actual
5. Pressure drop through filter banks.
6. Inlet pressure to fans
7. Discharge pressure from fans
8. Inlet pressure to unit
9. Discharge pressure from unit
10. Exhaust fan airflow, design and actual
11. Fan RPMs
12. Location
13. Minimum OA flow, design and actual.

E. Power HVAC Ventilators:
1. Location

2. Project identification number
3. Manufacturer
4. Model number
5. Serial number
6. Air flow, specified and actual
7. Total static pressure (total external), specified and actual
8. Inlet pressure
9. Discharge pressure
10. Sheave Make/Size/Bore
11. Number of Belts/Make/Size
12. Fan RPM
13. Method of initiation: Switch, BAS, thermostat

F. Air Terminal Unit Data:
1. Manufacturer
2. Type, constant, variable, single
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum design airflow, design and actual
8. Maximum design air flow, design and actual
9. Inlet static pressure

G. Domestic Hot Water Recirculating Balancing Valves:
1. Water flow, design and actual

H. Grilles, Registers, Diffusers:
1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design air flow
7. Test (final) air flow
8. Percent of design air flow.

END OF SECTION

SECTION 23 0713 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

C. Insulation jackets.

1.2 RELATED REQUIREMENTS

A. Section 22 0553 - Identification for Plumbing Piping and Equipment.

B. Section 23 0553 - Identification for HVAC Piping and Equipment.

1.3 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus ; 2004.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

D. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) ; 2005.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials ; 2008.

F. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association ; 2005.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc. ; 2003.

1.4 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

C. Adhesives, primers and Sealants: Provide Low-VOC adhesives and sealants in compliance with Section 01 61 16, VOC Content Restrictions. Submit documentation of VOC content.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Knauf Insulation
   2. Johns Manville
   3. Owens Corning Corporation

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' value: 0.30 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 250 degrees F.
   3. Maximum Water Vapor Absorption: 3.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.3 GLASS FIBER, RIGID

A. Manufacturer:
   1. Knauf Insulation
   2. Johns Manville
   3. Owens Corning Corp

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. 'K' Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 250 degrees F.
   3. Maximum Water Vapor Absorption: 3.0 percent.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Secure with two coats of vapor barrier mastic and glass tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.4 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
   1. Lagging Adhesive:
   2. Compatible with insulation.

B. Aluminum Jacket: ASTM B209 (ASTM B209M).
   1. Thickness: 0.016 inch sheet.
   2. Finish: Embossed.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.5 DUCT LINER

A. Manufacturers:

1. Knauf Insulation
2. Johns Manville
3. Owens Corning Corp

B. Insulation: Incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer or acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.
1. Apparent Thermal Conductivity: Maximum of 0.23 at 75 degrees F.
2. Service Temperature: Up to 250 degrees F.
3. Rated Velocity on Coated Air Side for Air Erosion: 6,000 fpm, minimum, when tested to UL 181.
4. 1.5 pound per cubic foot density.
5. Fire resistant skin surface.

C. Liner Fasteners: Galvanized steel, self-adhesive pad or impact applied with integral head.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with NAIMA National Insulation Standards.

B. Insulated ducts conveying air below ambient temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, and fire dampers.

C. Insulated ducts conveying air above ambient temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate ductwork and fittings, joints, and flanges.

D. Install in accordance with manufacturer's instructions.

E. Insulated ducts conveying air below ambient temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

F. Hangers, supports, anchors, etc. that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.

G. Ductwork insulation exposed in finished spaces: Finish with canvas jacket sized for field painting.

H. External Duct Insulation Application:
1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Lap all joints 2", seal with lap adhesive.
3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

I. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 100 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.
   6. Installation shall meet NFPA 90A and 90B fire resistant requirements.

3.3 SCHEDULES

A. Exhaust Ductwork within 30 feet of exterior openings in interior concealed locations:
   1. Flexible Glass Fiber Duct Insulation: 2 inches thick.

B. Exhaust Ductwork within 30 feet of exterior openings in interior exposed locations:
   1. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.

C. Rectangular Supply Air Ductwork from VAV boxes, concealed:
   1. Glass Fiber Duct Liner Insulation: 1 inch thick.

D. Rectangular Supply Air Ductwork from RTUs, interior exposed and concealed:
   1. Glass Fiber Duct Liner Insulation: 1 inch thick.

E. Rectangular Return Air Ductwork to RTUs, interior exposed and concealed:
   1. Glass Fiber Duct Liner Insulation: 1 inch thick.

F. Round Supply Air Ductwork, interior concealed:
   1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.

G. Rectangular Return ductwork to AHUs and RTUs, interior all:
   1. Glass Fiber Duct Liner Insulation: 1 inches thick.

END OF SECTION

SECTION 23 0914 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sensors.

B. Automatic dampers.

C. Damper operators.

1.2 RELATED REQUIREMENTS

A. Section 23 3300 - Air Duct Accessories: Installation of automatic dampers.

B. Section 23 0993 - Sequence of Operations for HVAC Controls.

C. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 SUBMITTALS

A. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

B. Manufacturer's Instructions: Provide for all manufactured components.

C. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.4 WARRANTY

A. Correct defective Work within a two year period after Substantial Completion.

1.5 SUMMARY

A. This section includes control equipment for HVAC system and components, including control components for heating and cooling units not supplied with factory controls.

1.6 COORDINATION

A. Coordinate location of temperature sensors with plans and existing room details before installation.

B. Coordinate power supply for control units with Electrical Contractor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Siemens (G&R Controls, Sioux Falls, SD).

B. Johnson Controls (Johnson Controls, Sioux Falls, SD)

C. Schneider Electric (Climate Systems, Sioux Falls, SD)

2.2 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

B. All controls conduit shall be furnished by the temperature controls contractor in accordance with the Electrical Specifications.

2.3 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

B. Provide common keying for all panels.

2.4 DAMPERS

A. Performance: Test in accordance with AMCA 500-D.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 16 gage.

C. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 16 gage, attached to minimum 1/2 inch shafts with set screws.

D. Blade Seals: Synthetic elastomeric mechanically attached, field replaceable.

E. Jamb Seals: Spring stainless steel.

F. Shaft Bearings: Graphite impregnated nylon sleeve, with thrust washers at bearings.

G. Linkage Bearings: Graphite impregnated nylon.

H. Leakage: Less than one percent based on approach velocity of 2000 ft/min and 4 inches wg.

I. Maximum Pressure Differential: 6 inches wg.

J. Temperature Limits: -40 to 200 degrees F.

2.5 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
   1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
   2. Provide one operator for maximum 36 sq ft damper section.

B. Coupling: V-bolt and V-shaped, toothed cradle.

C. Overload Protection: Electronic overload or digital tration-sensing circuitry.

D. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring return actuators.

E. Power Requirements: 24 V ac.

F. Temperature Rating: -22 degrees F to 122 degrees F.

G. Run time: 30 seconds.

2.6 INPUT/OUTPUT SENSORS

A. DDC Room Sensors:
   1. Room temperature sensors for ERCPs.
      a. Accuracy: Plus or minus 1 degree F at calibration point.
      b. Temperature Range: 55 degrees F to 95 degrees F.
      c. Occupied Heating Setpoint: 70 degrees F.
      d. Unoccupied Heating Setpoint: 65 degrees F.
      e. Provide with 2 line LCD display that permits viewing of controller points. No temperature or occupancy override.
      f. Color: Factory Standard.
   2. Room temperature sensors for electric cabinet unit heaters and electric unit heaters.
      a. Accuracy: Plus or minus 1 degree F at calibration point.
      b. Temperature Range: 55 degrees F to 95 degrees F.
      c. Occupied Heating Setpoint: 70 degrees F.

d. Unoccupied Heating Setpoint: 65 degrees F.
e. Provide with stainless steel cover plate.
f. Color: Stainless Steel.

3. Room temperature sensors for VAVs:
a. Accuracy: Plus or minus 1 degree F at calibration point.
b. Temperature Range: 55 degrees F to 95 degrees F.
c. Occupied Cooling Setpoint: 74 degrees F.
d. Unoccupied Cooling Setpoint: 77 degrees F.
e. Occupied Heating Setpoint: 70 degrees F.
f. Unoccupied Heating Setpoint: 65 degrees F.
g. Provide with 2 line LCD display that permits viewing and modification of controller points.
h. Color: Factory Standard.
i. Provide with flush mounted occupancy override button that allows an occupant to revert to an occupied control schedule during BAS unoccupied schedule for a maximum period of 3 hours after initiation.
j. BAS shall allow the cooling setpoint to be adjusted at the sensor for a maximum period of 3 hours after first initiation. The BAS shall also not allow the cooling setpoint to be adjusted at the sensor to below 73 degrees F.
k. BAS shall allow the heating setpoint to be adjusted at the sensor for a maximum period of 3 hours after first initiation. The BAS shall also not allow the heating setpoint to be adjusted at the sensor to above 72 degrees F.

B. Supply air duct discharge temperature sensors (RTU and VAVs):
1. Description: Single point 4-20 mA platinum RTD.
2. Reference Resistance: Plus or minus 1.2 degrees F.
3. Operating temperature range: -4 degrees F to 122 degrees F.
4. Wire: Twisted, shielded pair cable.

C. Return air duct temperature sensors (RTU):
1. Description: Single point 4-20 mA platinum RTD.
2. Reference Resistance: Plus or minus 1.2 degrees F.
3. Operating temperature range: -4 degrees F to 122 degrees F.
4. Wire: Twisted, shielded pair cable.

D. Current Sensors for fan/pump proving:
1. Description: Combination current switch and command relay.
2. Operating temperature range: -15 degrees C to 60 degrees C.
3. Operating humidity range: 0-95% RH.
4. Amperage Range: 1 to 135 amps.

E. Return air duct humidity sensors (RTU):
1. Description: Single point 4-20 mA platinum RTD.
2. Reference Resistance: Plus or minus 5% RH.
3. Operating humidity range: 0-95% RH.
4. Wire: Twisted, shielded pair cable.

F. Outside air temperature sensors:
1. Description: Single point 4-20 mA platinum RTD.
2. Temperature accuracy: Plus or minus 1.2 degrees F.
3. Operating temperature range: -40 degrees F to 240 degrees F.
4. Wire: Twisted, shielded pair cable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

C. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

D. Provide conduit and electrical wiring in accordance with Section 26 2717. Electrical material and installation shall be in accordance with appropriate requirements of Division 26. Conduit for wiring shall be utilized in all areas exposed to view.

E. Connect and configure equipment and software to achieve sequences of operation specified.

F. Install guards on sensors in the following areas:
   1. Wellness Room.

G. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches above floor. Align with lighting switches and humidistats/CO2 sensors.

H. Mount outdoor thermostats and outdoor sensors indoors, with sensing elects outdoors with sun shield. Locate sensor on north side of building.

I. Provide isolation (two position) dampers of parallel blade construction. Provide modulating (multiple position) mixing dampers of opposed blade construction.

J. Mount freeze protection thermostat using flanges and element holders.

3.3 CONNECTIONS

A. Ground Equipment.
   1. Tighten electrical connector and terminal according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, including piping and electrical connections.

B. Engage a factory authorized service representative to perform startup service.

C. Replace any components that become damaged or malfunctioning during construction.

D. Verify DDC as follows:
   1. Verify software including automatic restart, control sequencing, alarms, and occupied/unoccupied scheduling.
   2. Verify operation of new operator workstation.
   3. Verify local control units including self-diagnostics.

3.5 DEMONSTRATION

A. Train Owner's designated personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.

B. Provide operator training on workstation data display, alarms and descriptors, changing adjustable values, resetting to default values, and requesting logs. Include a minimum of 6 hours dedicated instructor time on site.

C. Review data in O&M manuals.

3.6 ON-SITE ASSISTANCE

A. Within one year of substantial completion, provide up to five project site visits, when requested by Owner, to adjust and calibrate components and to assist the Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

END OF SECTION

SECTION 23 0993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.

B. Sequence of operation for:
   1. Variable air volume rooftop units.
   2. Toilet and general exhaust fans.
   3. Electric radiant ceiling panels.
   4. Electric unit heaters.
   5. Electric cabinet unit heaters.
   6. Domestic hot water system.
   7. Variable air volume boxes

1.2 RELATED SECTIONS

A. Section 23 0914 - Instrumentation and Control Devices for HVAC.

1.3 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.4 SUBMITTALS

A. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
   1. Label with settings, adjustable range of control and limits.
   2. Include written description of control sequence.
   3. Include flow diagrams for each control system, graphically depicting control logic.
   4. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

B. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 MISCELLANEOUS

A. The Temperature Control Contractor shall provide all control wiring for all equipment provided under Division 23 unless specifically stated otherwise herein.

B. All cabling which is not routed within conduit shall be plenum rated as per requirements of Division 26 and Division 28.

3.2 TOILET EXHAUST FANS (EF-1):

A. During occupied operation, the BAS shall index the exhaust fan to run continuously. Provide current switch on fan and alarm BAS workstation when the fan fails to operate when called upon to do so.

B. Whenever the fan is operating, the BAS shall fully open the motorized damper in the ductwork up to the rooftop exhaust. The BAS shall fully close the damper whenever the exhaust fan is not operating.

3.3 SHUTOFF VAV TERMINALS:

A. Cooling:

1. During unoccupied/occupied operation, the BAS shall modulate the VAV damper open as required to maintain space temperature cooling set point.

B. Heating:
1. During occupied/unoccupied operation, the BAS shall open the VAV box damper to minimum heating cfm and modulate the SCR electric heating coil as required to maintain space heating set point. If a 85 degree F VAV box discharge air temperature is reached, the VAV box damper is at minimum position, and additional heating is required, open the VAV box damper and modulate the SCR electric heating coil together to maintain 85 degree F discharge temperature until space heating set point is satisfied.

C. The BAS shall allow a limit on local adjustment of space temperature set point of plus or minus 2F from BAS set point.

3.4 VARIABLE VOLUME ROOFTOP UNIT (RTU-1):

A. During occupied operation, the BAS shall index the supply fan in the RTU to run continuously. Current switch on fan shall alarm BAS workstation when the fan fails to operate when called upon to do so.

B. The BAS shall maintain the desired discharge air temperature by engaging the cooling or modulating the gas heating. The BAS shall reset the discharge air temperature from 55 degrees F (summer) to 60 degrees F (winter).

C. In cooling, the BAS shall modulate the capacity of the lead compressor. When the lead compressor is at 100% and the discharge air temperature set point cannot be maintained, modulate the lead compressor down to 50%, start the lag compressor at 50%, and modulate both compressors up from 50% to maintain discharge air temperature setpoint. Rotate lead/lag compressor on the 1st of each month.

D. During occupied operation, the RTU outside air damper shall modulate to maintain the minimum outside air flow. The BAS shall utilize the airflow measuring station on the RTU outside air intake to maintain damper position.

E. During unoccupied operation, the BAS shall cycle the RTU supply fan and stage the cooling or modulate the gas heating as required to satisfy the unoccupied space temperature set point at worst case zone calling for heating/cooling.

F. Provide differential pressure sensors across each filter bank to monitor pressure drop and alarm BAS whenever the differential pressure exceeds 0.5" wc (adj).

G. The unit outside air and return air dampers shall modulate inversely proportional to each other.

H. During occupied operation, whenever the temperature directly downstream of the cooling coil reaches -5F, stop the unit supply fan and initiate an alarm at the operator workstation.

I. Provide the following sensors for monitoring only:
1. Return air temperature.
2. Return air humidity.
3. Mixed air temperature.

J. A high duct static pressure switch, located in the supply air ductwork close to the RTU connection, shall stop the supply fan and send an alarm to the BAS operator workstation whenever the duct static pressure exceeds 3" w.g.

K. The BAS, with its duct static pressure sensor located 2/3 the way down longest run of supply ductwork, shall maintain the supply air static pressure of 1.25" (adj) by modulating the VFD on the RTU supply fan. The final max. static set point shall be set during final air balancing.
1. Duct Static Pressure Reset: The BAS shall reset the controlling duct static pressure, in increments of 0.05" every 3 minutes (adj), to maintain most open VAV box on system at 90% open. In other words, if the most open VAV box is below 90% open, the BAS will lower the duct static pressure set point to drive box to 90% open. Conversely, if the most open VAV box is above 90%, the BAS will increase the duct static pressure set point to drive the VAV box to 90% open.

L. Economizer mode:

1. This mode shall only occur when the RTU is calling for cooling, is in occupied mode, and the enthalpy of the outside air is less than the enthalpy of the return air. Enthalpy of the return air is a calculated point from measuring return air temperature and humidity. Enthalpy of the outside air is a calculated point from measuring outside air temperature and humidity.
2. The BAS shall modulate open the outside air damper as required to satisfy discharge air temperature set point. The BAS shall modulate the return air damper inversely proportional to the outside air damper. In other words, as one damper closes, the other will open proportionally.
3. During economizer mode, the outside air damper shall not be allowed to go below its minimum outside air position. The BAS shall utilize the airflow measuring station in the outside air inlet to properly position the outside air damper.

M. Unit exhaust fan control:
1. The exhaust fan shall operate only whenever the RTU is in occupied mode. Provide current sensor on fan and alarm BAS operator workstation whenever the fan fails to operate when called upon to do so.
2. The BAS shall operate and modulate the exhaust fan in RTU to maintain space pressure set point at +0.02".

3.5 ELECTRIC UNIT HEATER (EUH-1):

A. Upon a call for heating, start air curtain supply fan and energize electric heating to maintain space temperature set point.

3.6 ELECTRIC CABINET UNIT HEATERS (ECUH):

A. Upon a call for heating, start air curtain supply fan and energize electric heating to maintain space temperature set point.

3.7 ELECTRIC RADIANT CEILING PANEL (ERCP-1):

A. Upon a call for heating, the BAS shall energize the radiant ceiling panel through a relay on the power circuit, to be provided by the temperature controls contractor.

3.8 DOMESTIC HOT WATER RECIRCULATION PUMPS (DCP-1):

A. Provide aquastat on suction side of recirculation pump. Cycle pump as required to maintain minimum 100 degrees F at aquastat.

3.9 DOMESTIC HOT WATER SYSTEM (WH-1):

A. A temperature sensor shall be installed in the hot water discharge water piping from each water heater. The BAS shall initiate an alarm at the BAS workstation whenever the temperature rises above 150F.

3.10 MECHANICAL ROOM EXHAUST FAN (EF-2):

A. The BAS shall cycle the fan to maintain space temperature set point of 85F. Provide current switch on fan and alarm BAS workstation when the fan is off.

B. Whenever the fan is operating, the BAS shall fully open the motorized damper in the ductwork to the wall louver and in the ductwork to the exhaust fan. Whenever the fan is off, the BAS shall fully close the both dampers.

END OF SECTION

SECTION 23 2776 - PACKAGED ROOFTOP UNITS

PART 1: GENERAL

1.1 SECTION INCLUDES

A. Packaged Rooftop air conditioners.

1.2 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AMCA 99—Standards Handbook

C. AMCA 210—Laboratory Methods of Testing Fans for Rating Purposes

D. AMCA 500—Test Methods for Louver, Dampers, and Shutters.

E. AHRI 340/360 - Unitary Large Equipment

F. NEMA MG1—Motors and Generators

G. National Electrical Code.

H. NFPA 70—National Fire Protection Agency.

I. SMACNA—HVAC Duct Construction Standards—Metal and Flexible.

J. UL 900—Test Performance of Air Filter Units.

1.3 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics, and connection requirements.

B. Product Data:
   1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, and electrical characteristics and connection requirements.
   2. Provide computer generated fan curves with specified operating point clearly plotted.
   3. Manufacturer's Installation Instructions.

C. Operationg and Maintenance Data:
   1. Maintenance Data: Provide instructions for installation, maintenance and service.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.

B. Startup must be done by trained personnel experienced with rooftop equipment.

C. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Accept products on site and inspect for damage.

C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.6 EXTRA MATERIALS

A. Provide two extra sets of filters for each RTU.

1.7 WARRANTY

A. Provide 5 year compressor warranty.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. Daikin

B. Greenheck

2.2 GENERAL DESCRIPTION

A. Furnish as shown on plans, Daikin Applied Rebel Single Zone Heating and Cooling Unit(s) model DPS. Unit performance and electrical characteristics shall be per the job schedule.

B. Configuration: Fabricate as detailed on prints and drawings:
   1. Return plenum / economizer section
   2. Filter section
   3. Cooling coil section
   4. Supply fan section
   5. Gas heating section. - (APPLICABLE WHEN GAS HEAT OPTION IS SELECTED)
   6. Condensing unit section

C. The complete unit shall be cETLus listed.

D. The unit shall be ASHRAE 90.1-2019 compliant and labeled.

E. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with R-32 Refrigerant and oil. R-454B refrigerant shall also be acceptable.

F. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.

G. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

H. Performance: All scheduled EER, IEER, capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

2.3 CABINET, CASING, AND FRAME

A. Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" thick with an R-value of 7.0 and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.

B. Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat. Finished, unabraded panel surfaces shall be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16” at 1,000 hours minimum exposure to an ASTM B117 salt spray environment. Measurements of results shall be quantified using ASTM D1654 in conjunction with ASTM D610 and ASTM D714 to evaluate blister and rust ratings.

C. Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless-steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.

D. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal.

E. The unit base frame shall be constructed pre-painted steel to prevent base rail corrosion.

2.4 OUTDOOR/RETURN AIR SECTION

A. Daikin Applied UltraSeal low leak dampers shall be provided. Damper blades shall be fully gasketed and side sealed and arranged vertically in the hood. Damper leakage shall be less than 1.5 CFM/Sq. Ft. of damper area at 1.0 inch static pressure differential. Leakage rate to be tested in accordance with AMCA Standard 500. Damper blades shall be operated from multiple sets of linkages mounted on the leaving face of the dampers. Control of the dampers shall be from a factory installed actuator.

2.5 EXHAUST FAN

A. Exhaust fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

B. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

C. The BMS shall provide building static pressure control. The exhaust air fan output shall be controlled by BMS.

2.6 FILTERS

A. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2” prefilter and a 4” final filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2” MERV 8 and 4" MERV 14 filters.

B. All units shall be provided with a through the wall maginihelic filter gauge that displays filter loading on the exterior of the unit.

2.7 COOLING COIL

A. The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.

B. The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

C. The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

D. The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

E. The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

2.8 SUPPLY FAN

A. Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with fan blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

B. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.

C. Supply fan and motor assembly combinations larger than 8 hp or 22" diameter shall be internally isolated on 1" deflection, spring isolators and include removable shipping tie downs.

D. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

E. The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

2.9 VARIABLE AIR VOLUME CONTROL

A. The BMS shall proportionally control the Electronically Commutated Motors (ECM) on the supply and exhaust fans. The supply fan shall be controlled to maintain an adjustable duct pressure setpoint.

B. The unit manufacturer shall install all power and control wiring.

C. The supply air fan output shall be controlled by BMS.

2.10 HEATING SECTION

A. The rooftop unit shall include a natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.

B. The module shall be complete with furnace controller and control valve capable of 10:1 modulating operation.

C. The heat exchanger tubes shall be constructed of stainless steel

D. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

E. Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

F. The BMS control system shall control the gas heat modules.

2.11 CONDENSING SECTION

A. Outdoor coils shall be cast aluminum, micro-channel coils. Plate fins shall be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.

B. Outdoor air coils shall be protected from incidental contact to coil fins by a coil guard. Coil guard shall be constructed of cross wire welded steel with PVC coating.

C. Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit in ambient conditions up to 125°F. Mechanical cooling shall be provided to 0°F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

D. The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material.

E. The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature.

F. Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.

G. Refrigerant circuit shall have a bypass valve between the suction and discharge refrigerant lines for low head pressure compressor starting and increased compressor reliability. When there is a call for mechanical cooling the bypass valve shall open to equalizing the suction and discharge pressures. When pressures are equalized the bypass valve shall close and the compressor shall be allowed to start.

H. Each circuit shall be dehydrated and factory charged with R32 Refrigerant and oil. R-454B refrigerant will also be allowed.

2.12 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

B. A GFI receptacle shall be unit mounted. The receptacle shall be powered by a factory installed and wired 120V, 15 amp power supply. The power supply shall be wired to the line side of the unit's main disconnect, so the receptacle is powered when the main unit disconnect is off. This option shall include a GFI receptacle, 2.0 KVA transformer and a branch circuit disconnect. The electrical circuit shall be complete with primary and secondary overload protection.

C. An fused disconnect and 65,000 amp SCCR capability shall be provided.

2.13 CONTROLS

A. Field Installed DDC Controls by Others
   1. Controls shall be field provided and field installed by others.

2.14 ROOF CURB

A. A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

PART 3: EXECUTION

3.1 INSTALLATION

A. Install units with manufacturer's recommended clearances for service and maintenance.

B. Provide flexible duct connections on inlet and outlet from unit; refer to Section 233300.

C. Spill condensate from cooling coil drain pan onto roof with vented trap in accordance with manufacturer’s guidelines

3.2 SYSTEM STARTUP

A. Provide services of manufacturer's authorized representative to provide start up of unit. Representative shall also inspect field assembled components and equipment installation, including ductwork and electrical connections.

3.3 CLEANING

A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

3.4 DEMONSTRATION

A. Train Owner's directed personnel to adjust, operate, and maintain equipment.
   1. Train Owner's maintenance personnel on procedures for starting and stopping equipment, troubleshooting, routine servicing and maintenance.
   2. Review data complete in Operations and Maintenance manual.

END OF SECTION

SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

B. Flexible ductwork.

1.2 RELATED REQUIREMENTS

A. Section 23 0713 - Duct Insulation: External insulation and duct liner.

B. Section 23 3300 - Air Duct Accessories.

C. Section 23 3700 - Air Outlets and Inlets.

D. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Applications; 2012.

C. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2013.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2012.

H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 2011.

I. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

J. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

K. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication & Installation Guidelines; 2001.

1.4 SUBMITTALS

A. Product Data: Provide data for duct materials, including schedules with service, materials, and duct pressure class.

B. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for 2 inch pressure class and higher systems.

C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of experience.

1.6 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A and NFPA 90B standards.

B. Installation and construction of ductwork shall conform to SMACNA Standards.

1.7 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 DUCT ASSEMBLIES

2.2 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Insulated Flexible Ducts:
   1. Black polymer film supported by helically wound spring steel wire; 1" fiberglass insulation; polyethylene or aluminized vapor barrier film. Duct sizes on plans are inside dimensions
      a. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
      b. Maximum Velocity: 4000 fpm.
      c. Temperature Range: -20 degrees F to 175 degrees F.

C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. Sealants for flexible ductwork shall be compliant with UL 181B and shall be marked as 181B-M. Sealants for metallic ductwork shall be compliant with UL 181A and shall be marked at 181A-M.

D. Hanger Rod: ASTM A 36/A 36M; steel; threaded both ends, threaded one end, or continuously threaded.

2.3 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular mitered elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. T's, bends, and elbows: Construct according to SMACNA (DCS).

E. Brace turning vanes to prevent objectionable noise.

F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

G. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards.

H. Standard 45 degree lateral wye takeoffs unless otherwise indicated may be used where 90 degree conical tee connections are used.

I. All ducts over 18" wide shall be crossbroken.

J. No single thickness partitions between ducts will be allowed.

K. No open joints at the Corners or elsewhere will be allowed.

L. Traverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for mater thickness, reinforcement size and spacing, and joint reinforcement.
   1. Manufacturers:
      a. Ductmate Industries

b. Nexus

M. Formed-On Flanges: Construct accoring to SMACNA's "HVAC Duct Construction Standards", Figure 1-4, using corner, bolt cleat, and gasket details.
1. Manufacturers:
a. Ductmate Industries
b. Lockformer
2. Duct Size: Maximum of 30 inches wide and up to 2 inch w.g. pressure.
3. Longitudinal seams: Pittsburgh lock sealed with noncuring polymer sealant.

2.4 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacturers:
1. United McGill Corporation
2. Metal-Fab
3. Semco

B. Double Wall Insulated Rectangular Ducts: Rectangular spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
1. Manufacture in accordance with SMACNA (DCS).
2. Insulation:
a. Thickness: 1 inch (25 mm).

C. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
1. UL labeled.
2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
3. Pressure Rating: 4 inches wg (1000 Pa) positive and 0.5 inches wg (175 Pa) negative.
4. Maximum Velocity: 4000 fpm (20.3 m/sec).
5. Temperature Range: Minus 20 degrees F to 175 degrees F (Minus 28 degrees C to 79 degrees C).

D. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

E. Spiral Round Ducts:
1. Manufacture in accordance with SMACNA HVAC Duct Construction Standards.
2. Fittings: Manufacture at least two gages heavier metal than duct.
3. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
4. Provide "paintgrip" ductwork finish on all exposed round ductwork, ready for field painting.

2.5 HANGERS AND SUPPORTS

A. Building Attachment: Concrete inserts, powder-actuated fasteners, or structural-steel/wood fasteners appropriate for construction material to which hangers are being attached.
1. Use powder actuated concrete fasteners for standard weight aggregate concretes or for slabs more the 4 inches thick.
2. Exception: Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4 inches thick.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
1. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Constructions Standards-Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
2. Galvanized steel straps attached to aluminum ducts shall have contact surfaces painted with zinc chromate primer.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws compatible with duct materials. Screws man not be used in kitchen, dishwasher, or chemical fume exhaust ductwork.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A36/A36M.
1. Supports for galvanized steel ducts: Galvanized steel shapes and plates.
2. Supports for stainless steel ducts: Stainless steel support materials.

E. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards.

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

E. All ductwork shall be run substantially as shown on the plans with bends and curves. The A/E reserves the right to slightly change the run of certain ducts without extra cost to the Owner, if necessary to avoid unforeseen structural or other interferences.

F. Round branch duct connections to rectangular mains shall be made with spininoconical takeoff. Takeoff shall have volume damper with quadrant operator.

G. Butter and seal all transverse joints in supply ductwork. Apply sealer along entire length of joint before putting "drive" in place and apply a secondary layer of sealant or putty at corners before drive ends are bent over. On duct systems in the 4" W.G. and above pressure classification, the duct wall penetrations and longitudinal joints shall also be sealed. Sealant shall be similar to Dura-Dyne, 3M Ductseal 800 or equal.

H. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Use crimp joints with or without bead for joining round duct sizes 10 inch and smaller with crimp in direction of air flow.

K. Use double nuts and lock washers on threaded rod supports.

L. In connecting to masonry and/or stud wall construction, masonry flues, joining shall be made practically airtight by the use of caulking compounds, forced from the inside of the duct to the outside and then molded and clinched into place as not to permit leakage after setting. The caulking compound shall be such in character that it will remain resilient after final setting.

M. Flexible ductwork shall not be allowed on return or exhaust systems unless specifically noted on drawings.

N. Securely attach all ductwork to the building construction in a manner to be free from vibration and swaying under all conditions.

O. Flexible ductwork shall not be located in rated corridors (except where serving diffuser in corridor), or in exposed locations.

P. Flexible duct supports to be maximum 4'-0" o.c.

Q. Ducts shall be substantially supported with hangers located according to SMACNA standards. Hang ducts from beams and joists wherever possible.

R. No obstructions will be allowed in ducts except places where absolutely necessary and prior approval has been received from the A/E. In such cases they shall be installed so as to least interfere with the passage of air.

S. Connect diffusers to low pressure ducts directly or with 3 feet maximum length of flexible duct held in place with strap or clamp. Flexible duct runs shall not contain more than one 90 degree bend.

T. Connect flexible ducts to metal ducts with draw bands. Additionally tape the exterior of the insulation jacket to the metal duct's insulation.

U. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

V. At exterior wall louvers, seal duct to louver frame as required.

W. Install round ducts in lengths not less than 12 feet unless interrupted by fittings.

X. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

Y. Install ducts with a clearance of 0.5 inches, plus allowance for insulation thickness.

Z. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

AA. Coordinate ductwork layout with suspended ceilings, lighting layouts, and similarly finished work.

AB. Electrical Equipment Spaces: Route ducts to avoid passing through electrical equipment spaces and equipment dictating by current version of NEC.

AC. Fired Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers and firestopping sealant. Fireseal penetrations in accordance with current UL standard details.

AD. Non-Fired Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap opening on 4 sides by at least 1-1/2 inches.

3.2 SCHEDULES

A. Ductwork Material:
   1. Low Pressure Supply: Galvanized Steel.
   2. Medium Pressure Supply: Galvanized Steel.
   3. Return and Relief: Galvanized Steel.
   4. General Exhaust: Galvanized Steel.

B. Ductwork Pressure Class:
   1. Supply Ductwork from RTUs to VAVs: 3 inch.
   2. Return/Exhaust Ductwork to RTUs: 3 inch.
   3. General exhaust ductwork to rooftop exhaust fans: 1 inch.
   4. Supply air ductwork downstream of VAV boxes: 1 inch.

C. Ductwork Gage:
   1. Rectangular-Maximum Side:
      a. 30" or less: 24 gage.
      b. 31" to 54": 22 gage.
      c. 55" to 84": 20 gage.
      d. 85" and larger: 18 gage.
   2. Round - Diameter:
      a. 18" or less: 24 gage.
      b. 19" to 28": 22 gage.
      c. 29" to 38": 20 gage.
      d. 39" and larger: 18 gage.

END OF SECTION

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Duct access doors.

C. Duct test holes.

D. Flexible duct connections.

E. Volume control dampers.

1.2 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2002.

B. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2006.

C. NFPA 92A - Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences; 2006.

D. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.4 SUBMITTALS

A. Shop Drawings: Indicate for shop fabricated assemblies including; combination fire/smoke dampers, fire dampers, volume control dampers and duct access doors.

B. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.

C. Adhesives, primers and Sealants: Provide Low-VOC adhesives and sealants in compliance with Section 01 6116, VOC Content Restrictions. Submit documentation of VOC content.

1.5 PROJECT RECORD DOCUMENTS

A. Record actual locations of access doors and test holes.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps. Insulate turning vane to match adjacent ductwork.

2.2 DUCT ACCESS DOORS

A. Manufacturers:
   1. Nailor Industries Inc: www.nailor.com.
   2. Ruskin Company: www.ruskin.com.
   3. SEMCO Incorporated: www.semcoinc.com.
   4. United Enertech.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Doors shall be attached to duct with zinc plated cam latches. 18"x18" and smaller doors shall have a minimum of 2 latches, larger doors to have a minimum of 4 latches.

D. Panel shall set in rigid frame with sponge rubber gasketing to prevent air leakage.

E. Where ductwork is uninsulated, panels may be of single wall uninsulated construction.

F. Where ductwork is insulated, panels shall be of double wall construction with 1" rigid insulation fill.

G. Access doors with sheet metal screw fasteners are not acceptable.

2.3 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.4 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
   2. Net Fabric Width: Approximately 2 inches wide.

2.5 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Young Regulator.
   2. Nailor Industries Inc: www.nailor.com.
   3. Ruskin Company: www.ruskin.com.
   4. Cesco.
   5. Greenheck.
   6. United Enertech.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Single Blade Dampers: Fabricate for duct sizes up to 12 x 6 inch.
   1. Dampers shall have 16 gauge frame with 16 gauge blades with neoprene edge seals.
   2. Provide quadrants of suitable size for each damper.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Dampers shall have 16 gauge frame with 16 gauge blades with neoprene edge seals.
   2. Provide quadrants of suitable size for each damper.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters to extend shaft past insulation.

F. Cable Operating Volume Control Dampers:
   1. Manufacturers:
      a. Young Regulator.
   2. Description: External cable mount manual volume damper constructed of G60 galvanized steel, with galvanized steel cable casing and stainless steel cable. Provide with ceiling concealed box kit. Verify cable length with installation.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 3100 for duct construction and pressure class.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
   1. If above sizes do not fit, provide 2" smaller than duct size.

C. Access doors shall not be located in top side of duct.

D. Access doors shall be located in position to allow maintenance on the equipment being accessed.

E. Provide duct test holes where indicated and required for testing and balancing purposes.

F. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

H. Manual balancing dampers shall be provided with a locking type quadrant at exterior of duct.

I. Use of splitter dampers is prohibited.

J. Wash all flashings and counterflashing with acetic acid, and paint with one coat of lead and oil paint, black in color.

K. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

L. Provide cable operating manual volume dampers for all dampers installed above sheetrock ceilings.

M. Provide air turning devices on all mitered elbows.

END OF SECTION

SECTION 23 3423 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General rooftop power ventilators.

1.2 REFERENCE STANDARDS

A. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

B. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/certified/search/company.aspx.

C. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 2011.

D. UL 705 - Power Ventilators; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

E. Fans shall have been tested under AMCA 210-85, “Laboratory methods of Testing Fans for Rating, or British Standard 848, Part I, “Methods of Testing Performance”, 1980 and shall have been witnessed by an independent agency.

F. Sound testing shall be in accordance with AMCA 300.

1.3 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Manufacturer's Instructions: Indicate installation instructions.

C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.4 COORDINATION

A. Coordinate location and installation of wall supports and penetrations with the General Contractor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Greenheck: www.greenheck.com.

B. Loren Cook Company: www.lorencook.com.

2.2 ROOFTOP POWER VENTILATORS - GENERAL EXHAUST

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

G. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.

H. Roof Curb: 14 inch high above top of roof insulation surface or as indicated on drawings self-flashing of galvanized steel with continuously welded seams, built-in cant strips and factory installed nailer strip where indicated, and insulated.

I. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor for fans when noted on drawings.

J. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

K. All direct driven exhaust fans shall be provided with factory installed motor speed controller to assist in final air balancing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure wall exhausters with stainless steel lag screws to structure. Minimum of 2 screws per side.

C. Extend ducts to wall exhausters into structure. Counterflash duct to wall opening.

D. Provide sheaves required for final air balance as required by the Test and Balancing Contractor..

E. Secure roof exhausters with stainless steel lag screws to roof curb. Minimum of 2 screws per side.

F. Extend ducts to roof exhausters into roof curb. Counter flash duct to roof opening.

3.2 CONNECTIONS

A. Install ducts adjacent to power ventilators to allow service and maintenance.

B. Ground equipment.

C. Tighten electrical connectors and terminal according to manufacturer's published torque tightening values.

3.3 DEMONSTRATION

A. Train Owner's directed personnel to adjust, operate, and maintain equipment.
   1. Train Owner's maintenance personnel on procedures for starting and stopping equipment, troubleshooting, routine servicing and maintenance.
   2. Review data complete in Operations and Maintenance manual.

END OF SECTION

SECTION 23 3600 - AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single-duct terminal units.
   1. Single-duct, variable-volume units.

B. Integral heating coils.

C. Controls.

1.2 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

1.3 SUBMITTALS

A. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

B. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

PART 2 PRODUCTS

2.1 SINGLE-DUCT, VARIABLE-VOLUME UNITS

A. Basic Assembly:
   1. Casings: Minimum 22 gage galvanized steel.
   2. Liner: Internally lined with engineered polymer foam insulation which complies to UL181 and NFPA 90A. Insulation shall be 1½ pound density, closed cell foam. Exposed fiberglass is not acceptable. The insulation shall be mechanically fastened to the unit casing.
   3. Plenum Air Inlets: Round stub connections for duct attachment.
   4. Plenum Air Outlets: S slip and drive connections.

B. Basic Unit:
   1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud. Control housing to be provided with unit.
   2. Volume Damper: The damper shall be heavy gauge steel with shaft rotating in self-lubricating bearings. Shaft shall be clearly marked on the end to indicate damper position. Maximum damper leakage: 2 percent of design air flow at 1 inches rated inlet static pressure.
   3. Mount damper operator to position damper normally closed.

C. Damper Assembly:
   1. Shall consists of heavy gauge and galvanized steel construction with solid steel, nickel-plated shaft pivoting on HDPE; maximum damper leakage: 2% of design air flow at 1 inch inlet static pressure.
   2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
   3. Incorporate low leak damper blades for tight airflow shutoff.
   4. Airstream Temperature Sensor (Provided and installed under 23 0913 - Instrumentation and Control Devices for HVAC).

D. Electric Heating Coil:
   1. Listed and provided by the terminal unit manufacturer.
   2. Coil Casing: 20 gage, 0.0359 inch (0.92 mm) galvanized steel.

3. Heating Elements: 80/20 Nickel chrome, supported by ceramic insulators.
4. Integral Control Panel: NEMA 250, Type 2 enclosure with hinged access door for access to all controls and safety devices.
5. Furnish a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow.
6. Provide the following additional components, mounted and/or wired within the control enclosure:
   a. Fused or non-fused door interlocking disconnect switch.
   b. Mercury contactors.
   c. Fuse block.
7. Factory wired, including all limit switches and steps of control as indicated on the equipment schedule, with the SSR (solid-state relay) proportional heat control.
8. Provide SCR (Silicon Controlled Rectifier) controller.

E. Controls:
1. Controls for unit, including damper actuator, shall be field installed by the temperature controls contractor for the building. Install controllers inside factory installed control enclosure.
2. Airstream Temperature Sensor (Provided and installed under 23 0913 - Instrumentation and Control Devices for HVAC).

F. Accessories:
1. Access panel on bottom of unit housing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure. Do not support from adjacent ductwork.

D. Connect to ductwork in accordance with Section 23 3100.

E. Do not install terminal units above fixed furniture that will prohibit servicing of equipment.

3.2 DEMONSTRATION

A. Train Owner's directed personnel to adjust, operate, and maintain equipment.
1. Train Owner's maintenance personnel on procedures for starting and stopping equipment, troubleshooting, routine servicing and maintenance.
2. Review data complete in Operations and Maintenance manual.
3. Allow one hour of dedicated training time for terminal units.

END OF SECTION

SECTION 23 3700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Louvers.

1.2 REFERENCE STANDARDS

A. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006 (R2011).

B. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

1.3 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

B. Project Record Documents: Record actual locations of air outlets and inlets.

PART 2 PRODUCTS

2.1 GRD MANUFACTURERS

A. Krueger

B. Titus

C. Price

2.2 SQUARE CEILING DIFFUSERS

A. Type: Square, stamped, multi-core diffuser to discharge air in 360 degree pattern.

B. Frame: Inverted T-bar type. In gypsum board ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Aluminum with baked enamel standard white finish.

2.3 CEILING GRID CORE EXHAUST, TRANSFER, AND RETURN GRILLES

A. Type: Fixed cores of 1/2 x 1/2 x 1/2 inch spacing.

B. Fabrication: Aluminum with factory baked enamel standard white finish.

C. Frame: Channel lay-in frame for suspended grid ceilings, or, 1-1/4 inch (32 mm) margin with countersunk screw mounting for surface mount installations.

D. Where indicated in schedules, provide with neck mounted aluminum damper adjustable from the face of the grille, with removable key operator.

2.4 CEILING SLOT DIFFUSERS

A. Type: Continuous slot with adjustable vanes for right, left, or vertical discharge. See schedules for slot quantity and width.

B. Fabrication: Aluminum extrusions, with factory baked enamel standard white finish.

C. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

2.5 LOUVERS

A. Manufacturers:
   1. Ruskin
   2. Greenheck

B. Type: 6 inch deep with blades on 37.5 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch square aluminum mesh screen over exhaust and 1/2 inch square aluminum mesh screen over intake.

C. Fabrication: 12 gage thick extruded aluminum, welded assembly, with factory baked enamel finish color to be selected by the Architect.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers, grilles, and registers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION

SECTION 23 8200 - CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electric unit heaters.

B. Electric cabinet unit heaters.

1.2 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.

B. AHRI 440 - Performance Rating of Room Fan-Coils; 2008.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
   3. Indicate mechanical and electrical service locations and requirements.

B. Manufacturer's Instructions: Indicate installation instructions and recommendations.

C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

PART 2 PRODUCTS

2.1 ELECTRIC UNIT HEATERS

A. Manufacturers:
   1. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com/#sle.
   2. Marley.
   3. Berko.

B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

C. Assembly: Suitable for mounting from ceiling or structure above with built-in controls, thermal safety cut-out, and electric terminal box.

D. Housing:
   1. Suitable for ceiling or high altitude mount using provided hardware appendages.
   2. Horizontal Projection Units:
      a. Construction materials to consist of heavy gauge steel with galvanized, polyester powder coat, or high gloss baked enamel finish.
      b. Provide with threaded holes for threaded rod suspension.
      c. Provisions for access to internal components for maintenance, adjustments, and repair.

E. Air Inlets and Outlets:
   1. Inlets: Provide stamped louvers, protective grilles with fan blade guard, or _____.
   2. Outlets: Provide directional louvers.

F. Fan: Factory balanced, direct drive, axial type with fan guard.

G. Motor: Totally enclosed, thermally protected, and provided with permanently lubricated bearings.

H. Controls:
   1. Disconnect.
   2. 24-volt relay.
   3. Control transformer.

2.2 ELECTRIC CABINET UNIT HEATERS

A. Manufacturers:
   1. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com.
   2. Marley Engineered Products: www.marleymep.com.
   3. Berko.

B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to authority having jurisdiction as suitable for purpose indicated.

C. Heating Elements: Provide open-wire, finned tubular, or resistance wire enclosed in steel sheath.

D. Cabinet: Minimum 18 gauge, 0.0478 inch (1.21 mm) thick steel front panel with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet, and inlet grilles.

E. Finish:
   1. Factory applied, baked enamel finish.
   2. Color: As indicated on drawings.

F. Fan: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

G. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

H. Controls:
   1. Control transformer.
   2. Control relays.
   3. Thermal cutout with automatic reset to de-energize electric heating elements in the event of overheating.
   4. Fan speed switch.
   5. Thermostat.

I. Filter: Easily removed, 1 inch (25 mm) thick glass fiber throw-away type, located to filter air before coil.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.2 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.

C. Do not damage equipment or finishes.

D. Unit Heaters:
   1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.
   2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

E. Cabinet Unit Heaters:
   1. Install as indicated.
   2. Coordinate to ensure correct recess size for recessed units.

3.3 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Vacuum clean coils and inside of units.

C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

3.4 DEMONSTRATION

A. Train Owner's directed personnel to adjust, operate, and maintain equipment.

1. Train personnel on procedures for starting, stopping, troubleshooting, maintaining, and servicing equipment.
2. Review data in O&M manuals.

END OF SECTION

SECTION 26 0010 - GENERAL PROVISIONS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Quality Assurance
B. Methods of Request for Approval
C. Submittals
D. Job Conditions
E. Additional General Provisions
F. Definitions
G. Drawings and Measurements
H. Workmanship
I. Patching Materials
J. Equipment Housekeeping Pads
K. Equipment Clean-Up
L. Cutting and Patching
M. Sealing of Penetrations
N. Excavating, Trenching and Backfilling
O. Preparation
P. General Installation Requirements
Q. Existing Utilities
R. Laying Out the Work
S. Temporary Lighting and Power
T. Protection of Installed Work
U. Demonstration and Instruction
V. Adjusting
W. Project Record Documents
X. Warranty and Bonds

1.2 RELATED DOCUMENTS

A. The attached General Conditions, Supplementary General Conditions and Special Conditions or General Requirements are hereby incorporated into and shall become a part of all sections under DIVISION 26, 27 and 28 – ELECTRICAL. In certain instances where the terms of this Division of the Specifications conflict with the terms of the General Conditions, or Special Conditions, this Division of the Specifications shall govern (or the more stringent requirement shall apply).

B. Where “Contractor” is referred to in this Specification it shall mean “Contractor, Sub-Contractor and/or Sub-Contractors under the Prime Contractor.”

1.3 DESCRIPTION OF WORK

A. The work shall include everything in this Division of the Specifications and everything indicated on the Drawings that is complementary to this Division of the Specifications. Refer to the Index of Drawings to determine what Drawings apply directly to this work.

B. The requirements of Division 01 shall apply to all sections of Division 26, 27, and 28.

1.4 QUALITY ASSURANCE

A. Codes and Standards:
   1. Work, materials and manner of placing material shall conform in every respect with the latest provisions of Local, State and National Codes.
   2. Materials and equipment shall be new and of best quality, of the type best suited for the purpose intended, and be made by nationally recognized and substantially established manufacturers. The type and weight of material used for each purpose shall be as herein specified, and material shall conform with the requirements of the latest standard specifications of the "ASTM" for that particular material.
   3. Electrical materials used in this work shall be listed by the Underwriters Laboratories, Inc. where testing is provided and shall bear their label.
   4. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
   5. Where the notation of NEMA is indicated the equipment shall conform to National Electrical Manufacturers Association Standard.
   6. The following list of codes, technical societies, trade organizations and governing agencies shall set the standards by which all work shall be executed:
      a. City Electrical Ordinances
      b. State Electrical Laws and Statutes
      c. National Electrical Code (NEC) Current Edition
      d. National Board of Fire Underwriters (NBFU)
      e. National Electrical Manufacturers Association (NEMA)
      f. Underwriters Laboratories (UL)
      g. Electrical Testing Laboratory (ETL)
      h. International Building Code (IBC)
      i. International Fire Code (IFC)

B. Fees
   1. All fees, permits, licenses, etc., necessary in order to complete the work of this section shall be obtained and paid by this Contractor.

C. Alternate Equipment
   1. Where items of equipment and materials are specifically identified herein by a single manufacturer's name, or as many as three manufacturer's names, model or catalog numbers, and the words "or equal and approved" do not follow the manufacturer's names, only such specific items may be used in the base bid, except as hereinafter provided.
   2. Items of equipment of the Contractor's choice may be offered as alternates to such specified items, either in the spaces provided for same in the proposal form or if no space is provided, on the bidder's letterhead attached to each copy of the proposal form.
   3. Alternate proposal must be accompanied by full descriptive and technical data for item proposed, together with statement or amount of cost addition or deduction from the base bid if alternate is accepted. Substitutions proposed by the Contractor will not be considered in the award of the contract.
   4. The Contractor must judge that such alternate equipment is of equal quality and character to the specified equipment, and it is physically adaptable for installation within the allotted space with all required service clearances. Unless otherwise specified with this Division, the Engineer will not approve or disapprove any alternate equipment or materials before the bids are opened.
   5. The cost of any changes to other trades as a result of use of the alternate material or equipment must be borne by the Contractor submitting such material or equipment.

D. Equipment of Substitution:
   1. Where items of equipment and materials are specifically identified herein by a single manufacturer's name, or as many as three manufacturer's names, model or catalog numbers, and the

words “or equal and approved” follow the manufacturer’s name, such items may be substituted until such time that the “Schedule of Materials and Equipment” is submitted to the Architect or Engineer. The base bid and any alternate shall be based on materials only as specified or approved

1.5 METHODS OF REQUEST FOR APPROVAL:

A. Prior to the award of the contract, interested parties may request approval of substitute materials. Such requests shall be made per the requirements listed in Division 01.

B. Should the Contractor wish to use materials other than those specified or listed in Addenda they shall do so in compliance with the method as specified in Division 01.

C. The listing of any manufacturer as “acceptable” does not imply automatic approval. It is the sole responsibility of the Electrical Contractor to ensure that any price quotations received and submittals made are for products which meet or exceed the specifications included herein.

D. The Contractor must judge that such items of substitution are of equal quality and character to the specified items and it is physically adaptable for installation within the allotted space with all required service clearances. This includes the following:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same (or better) warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the Owner.
   4. Waives claims for additional costs or time extensions which may subsequently become apparent.
   5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities.

E. The cost of any changes to other trades as a result of use of the substitution material or equipment must be borne by the Contractor submitting such material or equipment.

F. After the award of the contract, any request for a substitution must be made in writing by the Contractor (not material supplier or Sub-Contractor). Such request shall state the name of the product specified, the name of the product proposed for substitution, the reason for requesting the substitution, and any change in contract amount resulting from the substitution. No such substitution shall be made until an appropriate Contract Modification has been issued and approved.

G. Manufactured materials hereinafter specified or shown on the Drawings shall be installed or applied in accordance with the directions of the manufacturer unless specifically designated otherwise in the Specifications or on the Drawings.

H. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

1.6 SUBMITTALS

A. Schedule of Materials:
   1. This Contractor shall submit for review, a complete schedule of materials and equipment, listing names of manufacturers, catalog numbers, or identifying description of all equipment of substitution as defined in Specification section Alternate Equipment and Equipment of Substitution. The schedule shall also include a list of Sub-Contractors.
   2. The schedule shall be submitted within fourteen (14) days after the award of contract and before ordering any materials. Items shall be listed in conformance with the numerical order of the articles in the Specification. Upon receipt of approval of the schedule the Contractor may place orders with suppliers to start the shop drawing process.
   3. The review of the schedule of materials and equipment by the Architect or Engineer shall not relieve the Contractor from responsibility for deviations from Drawings and Specifications unless such deviation has been called to the attention of the Architect or Engineer at the time of submission.

4. If a list of material is not submitted within fourteen (14) days after the award of the contract, is will be assumed that the Contractor has waived his option of selecting equipment and materials in favor of the Owner, but shall not waive his contract requirements to provide shop drawings.

B. Submittal of Shop Drawings:
   1. The Contractor shall submit shop drawings per the requirements of Division 01.
   2. Major components of the system shall be submitted at one time under a protective cover with each section indexed with visible file tabs. All equipment shall be labeled per the equipment tags on the drawings, ie. Motor names, fixture types, etc.
   3. Shop drawings shall indicate catalog number, dimensions, voltage and current characteristics, wire sizes, construction and rough-in data of all materials to be used. Each shop drawing shall be certified as being checked and approved by the Contractor before submittal.
   4. Shop drawings not indicated as being approved by the Contractor will be returned without review.
   5. The Contractor shall provide approved shop drawings to be submitted with the Operating and Maintenance Manual per requirements of Division 01.
   6. The following wording will appear on shop drawings reviewed by the Engineer. Contractors not wishing to comply with these conditions shall not submit a bid. "Corrections or comments made on the shop drawings during this review do not relieve Contractor from compliance with requirements of the Drawings and Specifications. This check is only for review of general compliance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating their work with that of all other trades and performing their work in a safe and satisfactory manner."
   7. The Engineer is not an error checker. Where the Contractor is submitting shop drawings that differ from the specifications, the Contractor must itemize in writing, each variance from the specifications. Failure to do so will be considered an error on the Contractors part and the specified materials shall be furnished. Shop drawings submitted in error or with errors as compared to Specifications and Drawings will be the responsibility of the Contractor to correct such error later.
   8. Shop drawings must only be those materials as specified or approved in published addendum. Others will be returned without review.
   9. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the completed Work.
   10. When revised for resubmission, identify all changes made since previous submission.
   11. The Engineer does not provide approval of shop drawings, only a review for general conformance with the design concept and information given in the Contract Documents. There shall be no indication, implied or otherwise, that this is the case.

C. Guarantee:
   1. The Contractor shall assume responsibility for any defects which may develop in any part of his work caused by faulty workmanship, material or equipment, and agrees to replace, repair or alter, at his expense, any such faulty workmanship, material or equipment that has been brought to his attention during a period of one year from the date of the final certificate for payment. Acceptance of the work shall not waive this guarantee.

D. Operating and Maintenance Instructions:
   1. This Contractor shall furnish copies of complete catalog data, manufacturer's literature and detailed manuals covering the operating, maintenance of equipment and parts list specified under this Division of the Specifications. Submit the O&M manuals per the requirements of Division 01.
   2. One copy of each shop drawing shall be included in the notebooks but shall not serve in lieu of maintenance and operating instructions. Temperature control diagrams must include a description of the sequence of control.
   3. The Contractor shall submit O&M Manuals to the Engineer, not the Owner, for review. The Engineer will forward the manuals to the Owner.

4. This Contractor shall also supervise the initial operation as required to acquaint him thoroughly with the best practice.
5. This Contractor shall furnish the Engineer with a written statement from the Owner indicating complete acceptance of the equipment data and instruction of the operator. The Engineer will not approve the request for final payment until such statement has been submitted.
6. Provide an electronic copy of the above.

E. Test Reports:
1. Work which is required to be placed within the construction or concealed shall be carefully tested and inspected before being permanently concealed.
2. Tests shall be made in the presence of the Engineer and the Owner, and shall meet with their approval. The Contractor shall notify the Engineer at a time sufficiently prior to the performance of any test to allow time for the Engineer to be present for the test.
3. The entire system shall be subject to a test at full operating and under normal usage conditions. This shall include voltage and current checks, resistance measurements and equipment operation. Defects in the work or workmanship which appear during these tests shall be properly remedied and a test again applied and continued to a satisfactory conclusion.
4. Electricity or other energy necessary for use in testing and adjusting and or the operation period will be supplied by the Owner.
5. Instruments for making tests shall be furnished by this Contractor.
6. After testing the apparatus, the entire system shall be operated for one week under normal conditions.
7. The final test shall be performed as soon as possible after the work is entirely completed
8. Test reports submitted electronically shall be in standard PDF format or submitted with software to view the file.

1.7 JOB CONDITIONS:

A. Fees and Service Charges:
1. Permits, licenses, fees and service charges required in connection with the work shall be secured and paid for by this Contractor, and upon completion of the work he shall furnish proof of acceptance from the proper Local and State Department having jurisdiction.

B. Electrical Symbols and Abbreviations:
1. Symbols and abbreviations are as indicated in legends on the Drawings.

C. Correlation of Work:
1. This Contractor shall be responsible for close correlation of his work with that of other Contractors and shall organize his work so that it will not interfere with or delay the work of other Contractors.
2. Field verification of scale dimensions on Plans is directed since actual locations, distances and levels will be governed by actual field conditions.
3. The Electrical Sub-Contractor shall check architectural, structural, plumbing, heating and ventilating plans to avert possible installation conflicts. Should drastic changes from original Plans be necessary to resolve such conflicts, the Sub-Contractor shall notify the Prime Contractor who in turn shall notify the Architect or Engineer and secure written approval and agreement on necessary adjustments before the installation is started.
4. Discrepancies shown on different Plans, or between Plans and actual field conditions, or between Plans and Specifications, shall promptly be brought to the attention of the Architect or Engineer for a decision.
5. Where a discrepancy exists between drawing and specifications or other disciplines the worst cost case shall be provided.
6. Coordinate work of alterations and renovations to expedite completion sequentially and to accommodate occupancy requirements.

7. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
8. Coordinate space requirements, supports, and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility to other installations, for maintenance, and for repairs.
9. Coordinate completion and clean-up of work of separate sections.
10. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

D. Final Inspection:
1. Upon completion of work, the Contractor shall notify the Architect or Engineer in writing and make arrangements for a final observation. The Contractor shall also submit the operating and maintenance manuals at this time. The Engineer will not schedule nor perform a final inspection without successful submittal of operating and maintenance manuals by the Contractor.
2. During the final observation, pre-final or follow-up final, the Contractor and all his Prime Sub-Contractors shall have the foreman of the project present.
3. After the final observation is made, the Contractor will receive a list of items requiring adjustment, correction, replacement, or completion.
4. The Contractor shall comply completely with all the listed requirements within a negotiated number of days of receipt of list. Should the Contractor fail to complete items on the list within this time limit, the Owner reserves the right to have the work completed by others and the cost deducted from the contract price, including change orders.
5. The Contractor shall notify in writing to the Architect and/or Engineer once all punch list items are corrected, that he is ready for a follow-up final. The written notice shall contain explanations for those known items not completed and a schedule for completing them.
6. The Architect and/or Engineer shall schedule a follow-up final to confirm completion. Repeated observation trips required of the Engineer by the Contractor’s inability to complete the project satisfactorily will require the Contractor to reimburse the Engineer for all incurred costs after the follow-up final observation.

1.8 ADDITIONAL GENERAL REQUIREMENTS

A. Refer to Division 01 for additional requirements on the following:
1. Pre-Construction Meeting.
2. Progress Meeting.
3. Construction Progress Schedule.
4. Submittals for Review.
5. Submittals for Project Closeout.
6. Number of copies of submittals.
7. Submittal procedures.

1.9 DEFINITIONS

A. Contractor
1. The term “Contractor” refers to the installation Contractor responsible for the furnishing and installation of all work indicated within this Specification.

B. Furnish
1. The term “furnish” is used to mean “purchase, supply, provide and deliver to the Project site, protect and provide interim storage and be ready for unloading, unpacking, assembly, installation, and similar operations in accordance with Manufacturer’s specifications.”

C. Provide
1. The terms “provide” means to “furnish and install, complete and ready for the intended use.”

D. Install
   1. The term “install” is used to describe operations at project site including the actual “unloading, unpacking, rigging in place, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations”.

E. Installer
   1. The “Installer” is the Contractor, Subcontractor and/or supplier who uses their own employees for performance of all construction

F. If Applicable:
   1. The term “if applicable” will be that work which may be required for completed construction at applicable locations, but is not necessarily shown or described in the Contract Documents.

G. As Necessary
   1. The term “as necessary” will be that work which is required for completed construction, but is not necessarily show or described in the Contract Documents.

H. As Required
   1. The term “as required” will be that work which is required for completed construction and is shown on the drawings or described in the project Specification.

I. Concealed
   1. The term “concealed” means hidden from sight, buried as in chases, furred spaces, shafts, fixed ceiling or embedded in construction.

J. Exposed
   1. The term “exposed” means bare, open to the elements, out in the open, uncovered.

K. Product
   1. The term “product” will mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

L. Substantial Completion
   1. “Substantial Completion” is deemed that the project is sufficiently complete to be utilized for its intended use as stated in the body of this written Specification.

M. Words in the singular will also mean and include the plural, wherever the context so indicates, and words in the plural will mean the singular, wherever the context so indicates.

1.10 DRAWINGS AND MEASUREMENTS

A. The extent of the system of equipment, materials, panels, conduits, wire, fixtures and connections as shown are in general diagrammatic and not for exact locations, except in certain cases, the drawings may include details giving exact location and arrangements.

B. The drawings are not intended to be scaled for roughing in measurements nor to serve as shop drawings.
   1. If BIM models are supplied to contractors for construction modeling, the Level of Development (LOD) of any model provided by the design team should be assumed to be no higher than LOD 200 as defined by Digital Practice Documents from the American Institute of Architects (AIA). There shall be no indication, implied or otherwise, that the LOD is higher than this level.

C. The Contractor shall consult the architectural, structural, mechanical, or equipment drawings for dimensions, obstructions, and location of equipment or other trades. Any discrepancies between architectural, structural, mechanical, or equipment drawings and the electrical work shown on these drawings shall be reported to the Engineers for adjustment.

D. The installation details, instructions, and recommendations of the manufacturer of the product used, or modified to obtain the best end result, shall be the basis of attaining installation of the products for usage on this project except where definite and specific instructions are set forth herein or details are shown on the plans.

E. Outlet devices, switches, panels, cabinets, fixtures and special equipment are shown on the drawings only in a schematic manner and not necessarily in their specific location. The Contractor shall be responsible for exact locations of the outlets to form a functional and aesthetic installation either by careful review of all architectural elevations, tile patterns, surface finishes, and equipment arrangements or by consultation with the Engineers and other trades involved.

F. This contractor's bid shall allow a minimum of 10 feet variance in location of each electrical outlet, light fixture, panelboard, motor, appliance, etc. shown on the plans.

1.11 WORKMANSHIP

A. The installation work included in this specification shall be performed in a neat workmanlike manner by people experienced and skilled in the Electrical trade. Only the best quality workmanship will be accepted. All exposed parts of the electrical wiring systems such as exposed conduits, flush plates, cabinet trim, fixtures, etc., shall be square and true with the building construction.

1.12 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

1.13 EQUIPMENT HOUSEKEEPING PADS

A. Fixed concrete bases for electrical equipment will be provided under Division 03. The Electrical Contractor shall inform Division 03 Contractor before bid time of all required pads so that the cost for these pads are included in the Division 03 bid. If this is not coordinated the Electrical Contractor is responsible for all costs associated with the installation of these pads.

B. Coordinate with Division 03 Contractor to assure that all the outside corners are beveled, anchor bolts are provided per equipment manufactures recommendations, and that the pad horizontal dimensions are 3" larger than the footprint of the equipment on all sides.

C. Provide reinforced concrete housekeeping pads for all floor mounted electrical equipment (i.e. motor control centers, distribution panels, step-down transformers, standby generators, etc.)

D. Provide anchor bolts, per equipment manufacturer's directions, to attach equipment to pads.

1.14 EQUIPMENT CLEAN-UP

A. Special care must be taken for protection of panels, switches, etc. All must be kept completely protected from weather elements, painting, etc. until the building is substantially completed. Damage from rust, paint, scratches, etc. shall be corrected as directed by the A/E.

B. Clean all light fixtures and lamps thoroughly, just prior to final inspection. Fixture globes, enclosures, shielding, etc. shall be cleaned by an approved method.

C. Protection of electrical equipment during painting of the building shall be the responsibility of the Painting Contractor. This shall not relieve the Electrical Contractor of the responsibility for checking to assure that adequate protection is being provided.

1.15 CUTTING AND PATCHING

A. In existing construction this Contractor shall perform all cutting required and all necessary patching after completion to restore the surface to its original condition, unless otherwise indicated.

B. Should the cutting of walls, floors, ceiling, partitions, etc., be required for proper installation of the work or apparatus of this Contractor, or be made necessary on account of his failure to give General Contractor proper information at the time required, such cutting shall be done at his own expense, restoring the work to its original condition.

C. All cutting and patching done by this Contractor shall be subject to the direction and approval of the A/E. This Contractor shall not endanger the stability of the structure by cutting, digging, or otherwise, and shall not at any time cut or alter work of any other contractor without A/E's consent.

1.16 SEALING OF PENETRATIONS

A. All penetrations for raceway, wire, etc. furnished under Division 26, 27, 28 of these specifications which penetrate fire and/or smoke walls and full height partitions (including chase walls), shall be sealed with a UL System specifically approved for the application.

1.17 EXCAVATING, TRENCHING AND BACKFILLING

A. This Contractor shall perform all excavation to the depths required, indicated on the drawings or specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from trench or other excavations to prevent slides or cave ins. All excavated materials not required or usable for backfilling shall be removed from the site. Necessary grading shall be done to prevent surface water from flowing into trenches or other excavations and onto adjacent property. Furnish all pumping required to keep excavated space clear of water during construction. The A/E will inspect excavation and approve soil conditions and direct procedure if unsatisfactory conditions are discovered. Provide sheeting and shoring as may be necessary for the protection of the work and the safety of personnel. Protect bottom of excavation from frost and do not place structures or pipe on frozen ground.

B. Except where excavations will be covered by at least 4” of concrete, this contractor shall provide electrical warning tape at least 6” above buried conduit or wire.

C. Backfill excavations below finished grades with similar materials to that removed in excavation, free from rubbish and other unsuitable material. Backfilling shall be done to finished grades indicated on drawings. If no finished grading is to be done in excavated areas, this Contractor shall backfill to existing grades and restore the surface to its original condition. All backfill shall be compacted in 6 inch lifts to 95% maximum density.

D. The Contractor shall be responsible for protecting trenches and provided adequate crossovers where pedestrian and vehicular traffic occurs. Guard rails, flags, lamps, etc. shall be used for such protection.

E. This Contractor shall be responsible for the replacement of existing street pavement, curbs, sidewalks, etc. removed or damaged by him in the course of the work unless such pavement, curbs and sidewalks are to be reconstructed under the General Contract. This Contractor shall make necessary arrangements to perform such repairs and shall pay all costs in connection therewith and include it in his bid.

F. Prior to any excavation, effort shall be made to determine whether underground installations (i.e., sewer, telephone, water, fuel, electric lines, etc.) will be encountered, and if so, where such underground installations are located. When the excavation approaches the estimated location of such installation, the exact location shall be determined and when it is uncovered, proper supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work prior to the start of actual excavation.

1.18 PREPARATION

A. Cut, move, or remove items as necessary for access to alterations and renovation work. Replace and restore at completion.

B. Remove unsuitable materials not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for furnished work.

C. Remove debris and abandoned items from area and from concealed spaces.

D. Close openings in exterior surfaces to protect existing work and salvage items from weather and extremes of temperature and humidity. Insulate ducts and piping to prevent condensation in exposed areas.

E. Prepare surfaces and remove surface finishes to provide for proper installation of new work and finishes.

F. Clean substrate surfaces prior to applying next materials or substance.

G. Seal cracks or openings of substrate prior to applying next material or substance.

H. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

1.19 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections.

B. Make neat transitions. Patch work to match adjacent work in texture and appearance.

C. All ceiling mounted devices (i.e. smoke detectors, speakers, light fixtures, etc.) shall be installed centered in ceiling tiles (unless otherwise noted). Coordinate with ceiling installer.

1.20 EXISTING UTILITIES

A. The plans indicate as accurately as possible the location , type and sizes of existing underground utilities at the site. It is the Contractor's responsibility to have all utilities located prior to starting work. Contractor shall contact appropriate utility company and One Call for locating utilities prior to commencement of any work. The Owner also has underground conduit and other systems in place. Contractor shall contact the Owner prior to excavation in any area to determine any items that may be impacted by excavation.

B. This Contactor shall protect all utilities and Owner items affected by his work, and shall repair any damage caused by his forces at no additional cost to the Owner.

C. The Owner and the Owners' of all underground facilities shall be notified at least 5 business days prior to excavation.

1.21 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect/Engineer of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly notify Architect/Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect/Engineer.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and layout by instrumentation and similar appropriate means.

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

1.22 TEMPORARY LIGHTING AND POWER

A. Comply with Division 01.

B. Provide all temporary facilities required to supply construction power and light. Install and maintain facilities in a manner that will protect the public and workmen. Comply with all applicable laws and regulations.

C. Upon completion of work, remove all temporary facilities from the project site.

D. The Electrical Contractor shall provide power and lighting for construction as outlined in the General Requirements and/or Special Conditions. Where required to be separately metered the Electrical Contractor shall supply all materials for metering. Electrical Contractor shall coordinate with the Construction Manager/General Contractor to ensure all costs for temporary power and all electrical usage

is paid for as part of this contract. The Contractors are responsible for any charges related to temporary power and its usage.

E. When the Electrical Utility is needed for specific power outages the Electrical Contractor will be responsible for paying any costs associated with utility shut downs and shall pay the Utility Company for any charges incurred.

1.23 PROTECTION OF INSTALLED WORK

A. Protect installed work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to prevent damage.

C. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

D. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

E. Prohibit traffic from landscaped area.

1.24 DEMONSTRATION AND INSTRUCTION

A. Contractor shall complete all start-up and perform all initial testing of each system prior to scheduling or requesting to schedule training. All systems shall be completely operational before training or demonstration will occur.

B. Demonstrate operation and maintenance of Products to Owner's personnel prior to date of final inspection.

C. Demonstrate operation and maintenance of Products to Owner's representative at a scheduled time with the Owner.

D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.

E. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner Personnel.

F. Utilize operation and maintenance e manuals as basis for instruction. Review contents of manuals with Owner's personnel in detail to explain all aspects of operation and maintenance.

1.25 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.26 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Record information concurrent with construction progress.

D. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Changes made by Addenda and modifications.

E. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Field changes of dimension and detail.
3. Details not on original Contract Documents.

F. At completion of project Contractor shall provide a minimum of two (2) sets of As-Built Record drawings. Additional sets shall be provided if required under General Requirements.

1.27 WARRANTY AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Sub-Contractors, suppliers and manufacturers, within ten days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

F. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Sub-Contractor, Supplier, and Manufacturer, with name address, and telephone number of responsible principal.

END OF SECTION 26 0010

SECTION 26 0505 - SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections and drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated on contract documents.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Architect/Engineer before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

F. An attempt has been made to show all devices and branch circuits. The electrical contractor shall visit the site to verify devices not shown, extent of conduit, boxes etc, & routings. All devices need to be removed in the demolition area unless noted on the drawings.

G. It is mandatory that the existing building remain in continuous and non-interrupted operation during remodeling/altering of the existing bldg. The specific area(s) being remodeled/altered at any scheduled time are obviously exclusive of the statement. Services to existing building shall be kept on continuous operation including power, lighting, telephone, fire alarm, etc. Any absolutely necessary interruption of these services to accomplish project construction shall be held to a minimum, arranged with the Owner through the general contractor two (2) weeks in advance. Temporary services shall be furnished and installed where necessary to accomplish this purpose. Temporary systems shall be removed only after new permanent services are installed, fully operational, tested and compliant.

H. Electrical Contractor shall refer to architectural drawings to familiarize themself with extent of alteration/remodeling work and more specifically note where new partitioning is being installed, where existing partitioning is being removed, where ceilings are being removed and or replaced, etc.

I. If existing devices to be reused, provide all necessary conduit, wire, and terminations between devices and head end panels i.e. new fire alarm devices (smoke detectors, heat detectors, pull stations, alarm horns, remote annunciators, etc.) and new fire alarm panel. Any existing switches or receptacles that are relocated shall be replaced by new.

J. If existing conduit is allowed to be reused it shall be supported per NEC and these specifications. Field verify the existing conditions prior to bidding.

3.2 PREPARATION

A. Owner personnel will identify any existing conduit and electrical equipment that is to remain in place. Coordinate with Owner personnel.

B. Services to areas not within the demolition/remodel areas shall be maintained.

C. Disconnect electrical systems in walls, floors, and ceilings to be removed.

D. Coordinate utility service outages with utility company.

E. Coordinate service outages with Owner. Temporary connections of power, telephone, and data to external buildings must be completed before modifications of those systems occur.

F. All required service and utility outages shall be scheduled in advance, and approved by School District in writing in advance.

G. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

H. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

I. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
   1. When necessary to tie into existing system, Contractor shall coordinate tie in with Owner. Campus wide fire alarm system must be maintained at all times. In the event the fire alarm system must be taken down for a period of time, the Contractor shall provide personnel to provide fire watch for entire period of down time.
   2. Notify Owner before partially or completely disabling system.
   3. Make notifications at least 24 hours in advance.

J. Existing Telephone, Data, and Television Systems: Maintain existing systems in service.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. If existing systems supporting/mounting methods are removed support/remount as required to meet the specifications for new.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

K. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate. For instance, if new hard ceilings are installed relocate junction boxes as required to maintain accessibility or provide access panels. Contractor shall field verify existing conditions, this shall include: conduit routing, junction box locations, surface/recessed applications, vertical height of components, seal-offs, etc. Documents will not indicate all the details of the electrical system, only main components & devices.

L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

M. Except where otherwise shown or noted on drawing - "to be retained, relocated" or hereinafter noted, all existing electrical equipment and material in areas to be remodeled/altered shall be removed where they interfere with proposed new construction and or interfere with proposed usage of space by Owner as follows:
   1. Remove any conduits protruding above finished floor, cap and finish over with floor material to match existing.

2. Remove all light fixtures, receptacles, switches, etc., as indicated, and associated wiring.

N. Remove all surface mounted conduit/boxes and their associated wiring. Remove all concealed raceways, boxes and wiring from partitions being demolished. Remove all existing wiring/cabling from all existing concealed raceways in partitions that are to remain relating to demolished devices.

O. In remodeled/altered areas any feeders, conduits, branch circuits, signal and telephone circuits, etc. Passing through the remodeled areas to serve (or be served from) existing adjacent, remote, or surrounding areas that are to remain, shall be retained and kept operational and shall be rerouted in all cases where they interfere with any new work or usage to be accomplished in the remodeled area.

P. Where devices are omitted from present branch circuits, the remaining devices shall be re-wired, if needed and as required, to remain on their respective circuits and in operating condition. Re feed from nearest panel or replacement panel. Where possible, electrical contractor may use existing branch circuit conduit, but new circuit wiring will need to be pulled. If existing circuiting is not available in the area of the electrical load, provide a new circuit from the panelboard servicing the area. Where practical, contractor will be allowed to reuse existing wiring, provided that it matches required color code. If contractor elects to exercise this option, he shall warrant used wire as new

Q. All wiring (power, lighting) not reused for remodeling areas, shall be completely removed back to associated panels. Empty boxes and conduits shall be removed beyond remodeled area (above ceiling).

R. EXISTING SHARED NEUTRALS: Existing wiring being reused that is sharing neutrals shall be replaced back to panel and new wiring with a dedicated neutral shall be installed. The use of handle ties is not allowed unless specifically noted.

S. Extend existing installations using existing materials where practical, and providing new materials and methods compatible with existing electrical installations. Refer to specific notes on the drawings.

3.4 SALVAGE ITEMS

A. Salvage items to be returned to Owner shall include, but are not limited to, fire alarm equipment, clocks, clock equipment, dimmers, dimming equipment (not reused), panelboards, circuit breakers, hand dryers, and door closers.

B. The Owner shall have salvage rights for existing equipment and wire removed and not reused. If Owner does not wish to keep this equipment, it shall become Contractor's property and be removed from the site, unless otherwise specified or shown.

C. Disposal of all electrical items (fluorescent lamps, fluorescent ballasts, HID lamps, HID ballasts, transformers, etc.) shall be done in full compliance with all applicable local, county, state, and federal requirements. This Contractor shall bear all costs (fees, permits, etc.) associated with these disposal requirements.

D. Check with Owner prior to removal of all items.

E. Items shall not be damaged during removal.

F. Deliver to the Owner all salvage items to be retained by owner. Deliver to owner determined site within the city limits.

G. The Owner shall have the first choice to accept existing devices being removed. Do not relocate existing devices - provide new unless otherwise noted.

H. Salvage items to be returned to Owner shall be as specifically noted on the drawings.

I. All demolition materials not scheduled to be salvaged shall become the Contractor's property, and shall be removed from the site and legally disposed of by or through the contractor.

3.5 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

D. Electrical contractor shall be responsible for his own demolition, removal, capping, storing, abandoning, disconnecting, relocating and reconnection of existing electrical equipment and material. All cutting, patching, repairing, replacement and refinishing, shall match the existing construction as nearly as possible.

END OF SECTION 26 0505

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wiring connectors.

D. Electrical tape.

E. Heat shrink tubing.

F. Oxide inhibiting compound.

G. Wire pulling lubricant.

H. Cable ties.

1.2 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

D. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).

E. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation; 2018 (Reapproved 2023).

F. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

H. NECA 104 - Standard for Installing Aluminum Building Wire and Cable; 2012.

I. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

J. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

P. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

R. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.4 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Furnish products listed and classified by Underwriters Laboratories inc. as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.6 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:
1. Where not otherwise restricted, may be used:
a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
b. Where concealed in hollow stud walls and above accessible ceilings for branch circuits up to 20 A.
1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.

H. VFD cable - provide for all motors with VFD's.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. When drawings specifically state reuse of existing cabling is acceptable it shall be tested and warranted as new. If cabling is removed reuse is not permitted.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

H. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
      a. Substitution of aluminum conductors for copper is permitted only for the following:
         1) Services: Copper conductors size 1/0 AWG and larger.
         2) Feeders: Copper conductors size 1/0 AWG and larger.
         3) Where aluminum conductors are substituted for copper, comply with the following:
            (a) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
            (b) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
            (c) Provide aluminum equipment grounding conductor sized according to NFPA 70.
            (d) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

I. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.
         3) Feeders conductors shall be sized for a maximum voltage drop of 3% at design load.
         4) Branch circuit conductors shall be sized for a maximum voltage drop of 5% at design load.
         5) This contractor shall derated conductor ampacity in areas of high ambient temperature per the NEC.
         6) Provide a separate neutral for each phase wire - NO SHARED NEUTRALS. This applies to single phase circuits only.
         7) Provide additional derating per NEC tables 310-16 through 310-31 note 8 for all home runs with more than 3 current carrying conductors in a reaceway.
   2. Control Circuits: 14 AWG.

J. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
   3. Color Code:
      a. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      b. Equipment Ground, All Systems: Green.
      c. Travelers for 3-Way and 4-Way Switching: Pink.

d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
e. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

2.4 METAL-CLAD CABLE

A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

E. Grounding: Full-size integral equipment grounding conductor.

F. Armor: Steel, interlocked tape.

2.5 **WIRING CONNECTORS**

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:
1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
3. Connectors for Aluminum Conductors: Use compression connectors.

C. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Aluminum Conductors: Use compression connectors for all connections.
7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.

8. Conductors for Control Circuits: Use crimped terminals for all connections.

D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

G. Mechanical Connectors: Provide bolted type or set-screw type.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
   1. For the connection to any of the following: utility transformer, exterior transformer, transition cabinet, or padmount transformer, provide long barrel, 2 hole NEMA spaced, tin plated copper compression connectors with hot dipped galvanized or stainless steel hardware consisting of 1/2 inch bolts, washers, lock washers, and nuts.
   2. Engineer to witness installation - schedule accordingly. With engineer approval photographs may be provided in lieu of engineer oversight. Coordinate required photos with engineer.

2.6 WIRING ACCESSORIES

A. Electrical Tape:
   1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
   2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
   3. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).

B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
   1. Provide for ALL aluminum conductor terminations, splices, etc.

C. Wire Pulling Lubricant:
   1. Listed and labeled as complying with UL 267.
   2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
   3. Suitable for use at installation temperature.

D. All permanent splices shall be made with compression type connectors. Split bolts shall not be permitted except for temporary wiring.

E. Solderless Pressure Connectors:
   1. Scotch lok brand not acceptable.

F. Splices and taps shall be approved by owner & engineer prior to installation. When allowed for conductor sizes No. 6 and larger splicing shall be compression with heat shrink insulation.

G. Where a circuit passes through an outlet box and is tapped, all leads should be pigtailed out to the wiring device, including the equipment ground wire. This prevents loss of neutral or ground during maintenance work.

H. All underground splices shall be waterproof/watertight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

F. If existing conductors are indicated to be re-used, the cable shall be tested and warranted as new.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location indicated.
   5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
      b. Increase size of conductors as required to account for ampacity derating.
      c. Size raceways, boxes, etc. to accommodate conductors.
   8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

I. Terminate cables using suitable fittings.
1. Metal-Clad Cable (Type MC):
   a. Use listed fittings.
   b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

J. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Identify conductors and cables in accordance with Section 26 0553.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 26 0010.

S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

T. Route wire and cable as required to meet project conditions.
1. Wire and cable routing indicated is approximate unless dimensioned.
2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.

U. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

3.4 FIELD QUALITY CONTROL

A. See Section 26 0010 - General Provisions, for additional requirements.

B. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Ground enhancement material.

1.2 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.3 PERFORMANCE REQUIREMENTS

A. Grounding system Resistance: 5 ohms maximum.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

F. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
   3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Metal In-Ground Support Structure:
      a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
   4. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   5. Ground Rod Electrode(s):
      a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
      b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
      c. Where location is not indicated, locate electrode(s) at least 5 feet (1.5 m) outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.

d. Provide ground enhancement material around electrode where indicated.

6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
   b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
   c. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.
8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
   c. Metal process piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame.

I. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
   a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
   b. Raceway Size: 3/4 inch (21 mm) trade size unless otherwise indicated or required.

c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

J. Cable Tray Systems: Also comply with Section 26 0536.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).
2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
a. Exceptions:
1) Use mechanical connectors for connections to electrodes at ground access wells.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
a. Exceptions:
1) Use exothermic welded connections for connections to metal building frame.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.

F. Ground Enhancement Material:
1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.

G. Oxide Inhibiting Compound: Comply with Section 26 0519.

H. Motor grounding
1. Provide field installed shaft grounding for all motors served by VFD's.
2. Provide Aegis SGR or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify existing conditions prior to beginning work.

E. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.
   2. Indoor Installations: Unless otherwise indicated, install with 4 inches (100 mm) of top of rod exposed.
   3. Engineer must be able to inspect installation prior to grounding being covered up or pictures must be provided of each component of the installation prior to covering up.

D. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 0553.

F. Bond together each metallic raceway (2" and larger) , pipe, duct and other metal object entering equipment enclosures. Use 2 AWG bare copper conductor per NEC.

G. General: Install electrical grounding systems where shown, in accordance with applicable portions of NEC, with NECA's “Standard of Installation”, and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.
   1. Neutral conductors, cable shields, metallic conduits, cable terminations, junction boxes, and other non-current-carrying metallic parts of equipment shall be grounded.
   2. Equipment frames of metal-enclosed equipment, medium-voltage cable shields at cable joints and terminations, metal splice boxes, and other non-current-carrying metal items, shall be grounded unless otherwise indicated. Connections to earth shall be made in the same manner as required for neutral grounding. Equipment operating at more than 750 volts to ground shall be provided with grounds separate from secondary neutral grounds.
   3. Coordinate with other electrical work as necessary to interface installation of electrical grounding system with other work.
   4. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.

H. Provide electrical service and distribution grounding system as indicated in drawings and outlined in this specification and as required by NEC.

I. Install ground electrodes at locations as required. Install additional rod electrodes as required to achieve specified resistance to ground.

J. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing.

K. Provide bonding to meet requirements described in Quality Assurance.

L. A new electrical service and distribution will be provided as part of this project. Contractor to not only provide new grounding system as indicated on drawings but Contractor to also provide bonding of existing grounding system to new grounding system. Contractor to ensure all items requiring bonding by NEC, including existing and new, shall be properly bonded.

M. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit. Terminate each end on suitable lug, bus, or bushing.

N. Terminate each end of equipment ground conductors in an approved lug or bus or bushing.

O. In general, equipment ground conductors are not indicated on the plans. Where ground conductors are required, conduit sizes shall be increased as required to comply with NEC conduit fill requirements.

3.3 **FIELD QUALITY CONTROL**

A. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

B. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

C. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 26 0526

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

B. Conduit and equipment supports.

C. Anchors and fasteners.

D. For communication cabling, see also specific sections.

1.2 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.4 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 25%. Include consideration for vibration, equipment operation, and shock loads where applicable.

5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.
3. Use only in concealed locations (i.e. above ceilings, within walls, etc.)

C. Supports: Fabricated of structural steel or formed steel members; galvanized or painted, as required.

D. Roof conduit supports: Provide approved conduit supports on roof – equal to Caddy pyramid or Cooper durablock.

E. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

F. Metal Channel/Strut Framing Systems:
1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
2. Comply with MFMA-4.
3. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
4. Channel Material:
    a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm).
6. Minimum Channel Dimensions: 1-5/8 inch (41 mm) wide by 13/16 inch (21 mm) high.

G. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2-inch (13 mm) diameter.
    b. Busway Supports: 1/2-inch (13 mm) diameter.
    c. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch (6 mm) diameter.
    d. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch (10 mm) diameter.
    e. Trapeze Support for Multiple Conduits: 3/8-inch (10 mm) diameter.
    f. Outlet Boxes: 1/4-inch (6 mm) diameter.
    g. Luminaires: 1/4-inch (6 mm) diameter.

H. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    b. Comply with MFMA-4.
    c. Channel Material: Use galvanized steel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
   1. Do not drill or cut structural members, unless specifically approved in writing by Structural Engineer.

D. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

E. Install surface-mounted cabinets and panelboards with minimum of four anchors.

F. In wet and damp locations, use steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.

G. All supports shall be securely positioned to the structure, not equipment or ceiling tile supports. Coordinate structure load capabilities with General Contractor.

H. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

I. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

J. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

K. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

L. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

M. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

N. Conduit Support and Attachment: See Section 26 0533.13 for additional requirements.

O. Box Support and Attachment: See Section 26 0533.16 for additional requirements.

P. Interior Luminaire Support and Attachment: See Section 26 5100 for additional requirements.

Q. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

R. Secure fasteners in accordance with manufacturer's recommended torque settings.

S. Remove temporary supports.

3.2 FIELD QUALITY CONTROL

A. See Section 260010 - GENERAL PROVISIONS for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 26 0529

SECTION 26 0533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Galvanized steel intermediate metal conduit (IMC).

C. PVC-coated galvanized steel rigid metal conduit (RMC).

D. Flexible metal conduit (FMC).

E. Liquidtight flexible metal conduit (LFMC).

F. Galvanized steel electrical metallic tubing (EMT).

G. Rigid polyvinyl chloride (PVC) conduit.

1.2 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

N. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

O. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

P. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

Q. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

R. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

S. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

T. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

U. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

V. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.4 SUBMITTALS

A. There are no shop drawing submittals required for this section.

B. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches (51 mm).

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Protect PVC conduit from sunlight.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
1. Under Slab on Grade: Use thinwall non-metallic conduit.
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
3. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) long sweep elbows wrapped with PVC tape where emerging from underground.
4. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape acceptable to authorities having jurisdiction to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
5. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches (100 mm) on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
6. Through floor risers shall be rigid metal conduit.
7. Minimum Size: 3/4 inch (19 mm).

D. Embedded Within Concrete:

1. Within Slab on Grade: Not permitted.

E. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
1. Liquid tight conduit with liquid tight fittings shall be used in pump rooms, kitchens, wells, sump pits, transformer connections, and other areas of moisture content

I. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).
1. Locations subject to physical damage include, but are not limited to:
a. Where exposed below 8 feet (2.4 m), except within electrical and communication rooms or closets.
b. Where exposed below 20 feet (6.1 m) in warehouse areas.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.

M. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
1. Maximum Length: 6 feet (1.8 m).

N. Flexible Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit (FMC).
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
a. Transformers.
b. Motors.

O. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC).

2.2 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.

C. Communications Systems Conduits: Also comply with Section 27 1000.

D. Provide conduit, fittings, supports, and accessories required for complete raceway system.

E. Provide products listed, classified, and labeled as suitable for purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuits: 1/2-inch (16 mm) trade size.
2. Branch Circuit Homeruns: 3/4-inch (21 mm) trade size.
3. Minimum Size: data/voice conduits - see voice & data system specification.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers: Republic Steel Company, Youngstown, Triangle, Allied, Wheatland, or approved equivalent.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   2. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
   4. All connectors shall have insulated throats.

2.4 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch (1.02 mm).

C. PVC-Coated Boxes and Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
   3. Material: Use steel or malleable iron.
   4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch (1.02 mm).

D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch (0.38 mm).

2.6 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   3. All connectors shall have insulated throats.

2.7 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

3. All connectors shall have insulated throats.

2.8 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.
3. Connectors and Couplings: Use compression/gland or set-screw type.
   a. Do not use indenter type connectors and couplings.
4. All connectors shall have insulated throats.

2.9 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

C. Provide equipment grounding conductor. Adjust conduit size accordingly.

2.10 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch (0.51 mm).

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).

E. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

F. Sealing Systems for Concrete Penetrations:

1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
3. Provide sealed fittings in conduits transitioning from conditioned areas to non-conditioned areas.
4. Seal conduits that route from inside to outside building.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.2 INSTALLATION

A. At contractor's option, existing conduit in remodeled areas may be reused for new branch circuits and feeders where practical, and as noted on the plans. Existing conduits shall meet all requirements for new conduit as specified herein, and shall be warranted as new by the contractor.

B. Install products in accordance with manufacturer's instructions.

C. Install conduit in accordance with NECA 1.

D. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.

E. Aluminum Rigid Metal Conduit (RMC): Install in accordance with NECA 102.

F. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.

G. PVC-Coated Galvanized Steel Rigid Metal Conduit (RMC): Install using only tools approved by manufacturer.

H. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

I. Install nonmetallic conduit in accordance with manufacturer's instructions.
   1. For all nonmetallic conduit runs 2 inch trade size and larger, all sweeps shall be of galvanized rigid construction. If sweeps are underground, sweeps shall be PVC coated.

J. Cut conduit square using saw or pipecutter; de-burr cut ends.

K. Bring conduit to shoulder of fittings; fasten securely.

L. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

M. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations.

N. Install no more than equivalent of four 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size.

O. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

P. Provide suitable pull string in each empty conduit except sleeves and nipples.

Q. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

R. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal conduits unless specifically indicated to be exposed.
   4. Unless otherwise approved, do not route exposed conduits:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   5. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
      a. Conduits shall be installed in organized manner with no crossing of conduits.
      b. Conduits shall be 4" below bottom of floor slab.
      c. Photos of installation shall be provided to Engineer for approval prior to fill and compaction.
   6. Arrange conduit to maintain adequate headroom, clearances, and access.

7. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
8. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
9. Route conduits above water and drain piping where possible.
10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
11. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
12. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
13. Group parallel conduits in same area on common rack.
14. Service conduits for basement gear (below grade) shall enter the building outside the footprint of the gear, shall be routed with conduits sloping up from the transformer, and shall have a pull box with weep holes located outside gear footprint. Bottom entry is not acceptable.
15. Provide 1/2" (minimum) conduits at each door frame opening that is to receive electrified hardware extending from each component in the frame and its' associated power supply (Refer to Section 08710) to a junction box located approximately 18" above the ceiling line at the affected door openings.
16. Conduit shall be installed as high as possible & up in joist space as tight to structure or deck as NEC allows. Verify with architect, engineer, & other trades for mounting height and routing of conduits prior to installation.
17. Route exposed conduit parallel and perpendicular to walls.
18. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
19. Route conduit under slab, and underground from point-to-point.
20. No conduit shall be run within concrete slabs unless specifically noted otherwise.
21. Maintain adequate clearance between conduit and piping.
22. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

S. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 0529.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
7. Use of spring steel conduit clips for support of conduits is not permitted.
8. Use of wire for support of conduits is not permitted.
9. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.
10. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
11. Arrange supports to prevent misalignment during wiring installation.

12. Group related conduits; support using conduit rack. Construct rack using steel channel ; provide space on each for 25 percent additional conduits.

T. Connections and Terminations:
   1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
   2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
   3. Use suitable adapters where required to transition from one type of conduit to another.
   4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
   5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
   6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
   7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
   8. Secure joints and connections to provide mechanical strength and electrical continuity.

U. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
   2. Make penetrations perpendicular to surfaces unless otherwise indicated.
   3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
   4. Conceal bends for conduit risers emerging above ground.
   5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
   6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
      a. Sealing shall be rubber boot system. Caulking around opening only is not acceptable.
   7. Provide metal escutcheon plates for conduit penetrations exposed to public view.
   8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400
   9. Where conduits pass through exterior walls or roofs, Contractor shall seal penetrations with materials outlined in Section 07 9200.
   10. Where conduits pass through smoke or fire rated walls Contractor shall seal penetrations with appropriate smoke and/or fire rated materials as outlined in Section 078400 and/or Section 26 0050.
   11. Biocontainment areas: All conduits, raceways, etc. that penetrate the biocontainment barriers shall be silicone sealed (or similar) on both the inside and the outside of the penetration to minimize air leakage.

V. Underground Installation:
   1. Minimum Cover, Unless Otherwise Indicated or Required:
      a. Underground, Exterior: 24 inches (610 mm).
      b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.
   2. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 0553.

W. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
   1. Secure conduits to prevent floating or movement during pouring of concrete.

X. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where conduits are subject to earth movement by settlement or frost.

Y. Conduit Sealing:
   1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
      a. Where conduits enter building from outside.
      b. Where service conduits enter building from underground distribution system.
      c. Where conduits enter building from underground.
      d. Where conduits may transport moisture to contact live parts.
   2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
      a. Where conduits pass from outdoors into conditioned interior spaces.
      b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

Z. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.

AA. Provide grounding and bonding; see Section 26 0526.

AB. Identify conduits; see Section 26 0553.

AC. All conduits to cable trays shall be bonded to the cable tray.

AD. Provide conduit seals where raceway enters the building from underground. Seal in accordance with NEC requirements.

AE. Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints.

AF. Provide grounding bushings on all conduits 2" and larger.

AG. Flexible metal conduit shall not be used in lengths longer then six feet.

3.3 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

C. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

3.6 **INTERFACE WITH OTHER PRODUCTS**

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 26 0050.

B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation

END OF SECTION 26 0533.13

SECTION 26 0533.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Wall and ceiling outlet boxes.

D. Pull and junction boxes.

1.2 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

K. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.4 SUBMITTALS

A. See Section 26 0010 - General Provisions, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Do not use "through-wall" boxes designed for access from both sides of wall.
   8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   9. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   10. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
   11. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:
   3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:
   1. Unless dimensioned, box locations indicated are approximate.
      a. Adjust box locations up to 10 feet (3m) if required to accommodate intended purpose without adjustment in contract amount.
   2. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
      b. Communications Systems Outlets: Comply with Section 27 1000.
   3. Locate boxes so that wall plates do not span different building finishes.
   4. Locate boxes so that wall plates do not cross masonry joints.
   5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
   7. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
   8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
      b. Do not install flush-mounted boxes with area larger than 16 square inches (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area.
   9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
   10. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
      a. Concealed above accessible suspended ceilings.
      b. Within joists in areas with no ceiling.
      c. Electrical rooms.
      d. Mechanical equipment rooms.
   11. Install in locations as shown on Drawings and approved by owner, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA70.
   12. Set wall mounted boxes at elevations to accommodate mounting heights as indicated.
   13. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
   14. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
   15. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

I. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

O. Close unused box openings.

P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

Q. Provide grounding and bonding in accordance with Section 26 0526.

R. Identify boxes in accordance with Section 26 0553.

S. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.

T. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

U. Set floor boxes level.

3.3 ADJUSTING

A. Adjust floor boxes flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. install knockout closures in unused box openings.

3.4 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.5 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

B. Clean exposed surfaces and restore finish.

END OF SECTION 26 0533.16

SECTION 26 0536 - CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal cable tray systems:
   1. Metal wire mesh/basket cable tray.

1.2 REFERENCE STANDARDS

A. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA BI-50016 - Cable Tray Installation Guidelines; 2024.

D. NEMA VE 1 - Metal Cable Tray Systems; 2017.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts. Coordinate work to avoid installation of obstructions within cable tray required clearances.
   2. Coordinate arrangement of cable tray with dimensions and clearance requirements of actual products to be installed.
   3. Coordinate work with placement of supports and anchors required for mounting.
   4. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of affected installers. Review proposed routing, sequence of installation, and protection requirements for installed cable tray.

C. Sequencing:
   1. Do not begin installation of cables until installation of associated cable tray run is complete.

1.4 SUBMITTALS

A. See Section 26 0010 - General Provisions, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials, fabrication details, finishes, and span/load ratings.

C. Shop Drawings: Include dimensioned plan views and sections indicating proposed cable tray routing, required clearances, and locations and details of supports, fittings, building element penetrations, and equipment connections.

D. Derating Calculations for Fiberglass Cable Tray Systems: Indicate span/load ratings adjusted for applicable service conditions.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual routing of cable tray and locations of supports.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

C. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NEMA BI-50016, except do not store cable tray outdoors without cover as permitted in NEMA BI-50016.

B. Handle products carefully to avoid damage to finish.

PART 2 PRODUCTS

2.1 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

A. Provide new cable tray system consisting of required components, fittings, supports, and accessories, as necessary for complete system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.

D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under service conditions at installed location.

E. Unless otherwise indicated, specified span/load ratings are based on safety factor of 1.5 and working load only (i.e., no additional concentrated static load), with ratings for metal cable tray systems in accordance with NEMA VE 1.

F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values, with values for metal cable tray systems in accordance with NEMA VE 1 including applicable allowable tolerances.

2.2 METAL CABLE TRAY SYSTEMS

A. Manufacturers:
1. Cablofil, a brand of Legrand North America, Inc: www.legrand.us/cablofil/#sle.
2. Cope, a brand of Atkore International Inc: www.copecabletray.com/#sle.
3. Thomas & Betts Corporation: www.tnb.com
4. GS Metals
5. Flextray
6. Cooper B-Line.

B. Comply with NEMA VE 1.

C. Material/Finishes:
1. Zinc Electroplated Steel: Comply with ASTM B633.

D. Metal Wire Mesh/Basket Cable Tray:
1. Material: Zinc electroplated steel or mill-galvanized before fabrication (pre-galvanized) steel.
2. Tray Depth: As indicated on drawings.
3. Span/Load Rating: As indicated on drawings.
4. Mesh Spacing: 2 by 4 inches (51 by 102 mm).
5. Tray Width: As indicated on drawings.

2.3 **SEE SECTION 27 1015 FOR CABLE TRAY WITHIN TELECOMMUNICATION ROOM**

2.4 **WARNING SIGNS**

A. Provide factory supplied stick on labels with "Warning! DO NOT USE CABLE TRAY AS A WALKWAY, LADDER, OR SUPPORT. USE ONLY FOR SUPPORT OF CABLES AND TUBING!" Provide a label every 20 feet.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage cable tray system has been completed.

B. Verify that field measurements are as indicated.

C. Verify that the dimensions and span/load ratings of cable tray system components are consistent with the indicated requirements.

D. Verify that mounting surfaces are ready to receive cable tray and associated supports.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install cable tray in accordance with NECA 1 (general workmanship), and NEMA VE 2.

C. Overall loads in cable tray shall not exceed 50 pounds per NEC requirements.

D. Use expansion connectors where required.

E. Where cable trays pass though smoke or fire rated walls, Contractor shall seal penetrations with appropriate smoke and/or fire rated materials as outlined in Section 26 0050.

F.

G. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.

H. Arrange cable tray to provide required clearances and maintain cable access.

I. Install cable tray plumb and level, with sections aligned and with horizontal runs at the proper elevation.

J. Metal Wire Mesh/Basket Cable Tray: Field fabricate fittings in accordance with manufacturer's instructions, using only manufacturer-approved connectors classified for bonding.
   1. Inside Radius of Fittings: 12 inches (305 mm).

K. Cable Tray Movement Provisions:
   1. Provide suitable expansion fittings where cable tray is subject to movement, including but not limited to:
      a. Where cable tray crosses structural joints intended for expansion.
      b. Long straight cable tray runs in accordance with NEMA VE 2.
   2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA VE 2.
   3. Set gaps for expansion fittings in accordance with NEMA VE 2.

L. Cable Provisions:
   1. Use suitable fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.
      a. Provide barrier between Voice/Data cabling and all other system cabling.
   2. Use suitable drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.
   3. Use suitable cable support fittings for long vertical cable tray runs with heavy cables.

M. Provide end closures at unconnected ends of cable tray runs.

N. Cable Tray Support:
   1. Use manufacturer's recommended hangers and supports, located in accordance with NEMA VE 2 and manufacturer's requirements, but not exceeding specified span unless otherwise approved by Engineer. Provide required support and attachment in accordance with Section 26 0529, where not furnished by cable tray manufacturer.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

O. Grounding and Bonding Requirements, in Addition to Requirements of Section 26 0526:

P. Comply with grounding and bonding requirements of NEMA VE 2.
   1. Metal Cable Tray Systems: Use suitable bonding jumpers or classified connectors to provide electrical continuity.
   2. Provide suitable equipment grounding conductor in each cable tray, except where cable tray contains only multiconductor cables with integral equipment grounding conductors. Do not use metal cable tray system as sole equipment grounding conductor.
      a. Equipment Grounding Conductor for Steel Cable Tray: Use bare or insulated copper conductor.
      b. Equipment Grounding Conductor for Aluminum Cable Tray: Use insulated copper conductor only; do not use bare copper conductor.
      c. Minimum Equipment Grounding Conductor Size: 6 AWG copper.
      d. Bond equipment grounding conductor to each cable tray section using suitable listed ground clamps. Separate bonding jumpers are not required where properly bonded equipment grounding conductor provides equivalent continuity.
   3. Ground and bond cable tray under provisions of Section 260526
      a. Provide physical and electrical continuity between tray components.
      b. Bond all associated conduits to tray.
      c. Provide a 6AWG bare copper equipment grounding equipment grounding conductor through entire length of tray; bond to each component.
      d. Connections to tray may be made using mechanical or exothermic connectors.

Q. Conduit Termination:
   1. Use listed cable tray conduit clamps (evaluated for bonding connection) to terminate conduits at cable tray.
   2. Provide insulating bushing at conduit termination to protect cables.
   3. Provide independent support for conduit.

R. Penetrations: Install firestopping to preserve fire resistance rating of building elements.
   1. See Section 07 8400 for additional requirements.

S. Identification Requirements:
   1. See Section 26 0553 for additional requirements.

T. Install cable tray covers where indicated and as follows:

U. Provide pull string in tray through the entire length.

V. Grind down all cut tray or cover to prevent cable damage.

W. Maintain fiber optic bending radius dimensions.

X. Where installed above hard (inaccessible) ceilings provide a 2' x 2' access door every 6 inches.

Y. Secure cables installed in cable tray to the tray with nylon tie wraps every 2 feet.

Z. Install warning signs at 20 feet centers along cable tray, located to be visible.

AA. Location of ventilation ducts and fire protection sprinkler piping shall take precedence over exact location of cable tray. Coordinate with installers of these systems prior to start of cable tray installation.

AB. Power circuit or feeder conductors shall not be run in the cable tray system.

AC. Cable tray may be used for all low voltage communications cabling unless specifically noted otherwise in other parts of this specification. Fire alarm cables shall not be run in the cable tray.

3.3 FIELD QUALITY CONTROL

A. Inspect cable tray system for damage and defects.

B. Correct deficiencies and replace damaged or defective cable tray system components.

END OF SECTION 26 0536

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Warning signs and labels.

E. Identification of conduit.

1.2 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.3 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.4 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    a. Switchboards:
        1) Identify power source and circuit number. Include location when not within sight of equipment.
        2) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
    b. Panelboards:
        1) Identify power source and circuit number. Include location when not within sight of equipment.
        2) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
        3) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
    c. Enclosed switches, circuit breakers, and motor controllers:
        1) Identify voltage and phase.
        2) Identify power source and circuit number. Include location when not within sight of equipment.
        3) Identify load(s) served. Include location when not within sight of equipment.
2. Service Equipment:
    a. Use identification nameplate to identify each service disconnecting means.
    b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification

acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

c. Use identification label at each piece of service equipment to identify the available fault current and the date calculations were performed.

3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
4. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
5. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
6. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
   a. Service equipment.
   b. Industrial control panels.
   c. Panelboards.
8. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
   b. Service Equipment: Include the following information in accordance with NFPA 70.
      1) Nominal system voltage.
      2) Available fault current.
      3) Arc Flash Label - clearing time of overcurrent protective device option not allowed.
      4) Date label applied.
9. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
2. Identification for Communications Conductors and Cables: Comply with Section 27 1000.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

C. Identification for Cable Tray: Comply with Section 26 0536.

D. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 27 1000.
2. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
3. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
   a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
4. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
   2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
   3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
   4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
   5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
   1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
   2. Legend:
      a. System designation where applicable:
         1) Fire Alarm System: Identify with text "FIRE ALARM".
      b. Equipment designation or other approved description.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height:
      a. System Designation: 1 inch (25 mm).
      b. Equipment Designation: 1/2 inch (13 mm).
   5. Color:
      a. Normal Power System: White text on black background.

D. Format for Receptacle Identification:
   1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
   2. Legend: Power source and circuit number or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch (5 mm).
   5. Color: Black text on clear background.

2.3 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.

2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conductors and Cables: Legible from the point of access.
8. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Secure rigid signs using stainless steel screws.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. See Section 26 0010 - General Provisions, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 0553

SECTION 26 0573 - POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 1 - Motors and Generators; 2021.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.4 SUBMITTALS

A. Study preparer's qualifications.

B. The study preparer shall submit the studies within 30 days after the electrical equipment submittals have been received for review by the engineer. **The electrical submittals will be reviewed, but will not be approved until the studies have been received and reviewed.**

C. Study reports, stamped or sealed and signed by study preparer.
   1. Must be a licensed PE in the state of the project.

1.5 POWER SYSTEM STUDIES

A. Scope of Studies:

1. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
2. Label the following:
    a. clearing time of service overcurrent protective devices at the service equipment.
    b. service equipment.
    c. Panelboards .
    d. Air conditioning and refrigeration equipment.
    e. Industrial Control Panels.
3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

B. General Study Requirements:
1. Comply with NFPA 70.
2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
1. Electrical Contractor is responsible for the following for all studies including thermography:
    a. Opening of all equipment included in the study for engineer inspection.
    b. Providing the bid lengths of all feeders
    c. Providing the complete shop drawings of equipment included in the study.
    d. Providing the final installed lengths of all feeders.
2. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
    a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
        1) Obtain up-to-date information from Utility Company.
        2) Utility Company: As indicated on drawings.
    b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
    c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
    d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
    e. Protective Devices:
        1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
        2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
    f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
    g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
    a. Maximum utility fault currents.
    b. Maximum motor contribution.

c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:
1. Comply with applicable portions of IEEE 242 and IEEE 399.
2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. Analyze protective devices and associated settings for suitable margins between time-current curves to achieve full selective coordination while providing adequate protection for equipment and conductors.

F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
b. For single-phase systems, study preparer software shall include single phase calculations - no 3-phase allowed.
3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
a. Maximum and minimum utility fault currents.
b. Maximum and minimum motor contribution.
c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:
1. General Requirements:
a. Identify date of study and study preparer.
b. Identify study methodology and software product(s) used.
c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
d. Identify base used for per unit values.
e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
f. Include conclusions and recommendations.
2. Short-Circuit Study:
a. For each scenario, identify at each bus location:
1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
2) Fault point X/R ratio.
3) Associated equipment short circuit current ratings.
b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
b. For each graph include (where applicable):
1) Partial single-line diagram identifying the portion of the system illustrated.

2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
3) Conductors: Damage curves.
4) Transformers: Inrush points and damage curves.
5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
6) Motors: Full load current, starting curves, and damage curves.
7) Capacitors: Full load current and damage curves.

c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
2) Include ground fault pickup and delay.
3) Include fuse ratings.
4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:
a. For the worst case for each scenario, identify at each bus location:
1) Calculated incident energy and associated working distance.
2) Calculated arc flash boundary.
3) Bolted fault current.
4) Arcing fault current.
5) Clearing time.
6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 40 calories per sq cm.

1.6 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
1. Products:
a. EasyPower LLC: www.easypower.com/#sle.
b. ETAP/Operation Technology, Inc: www.etap.com/#sle.
c. SKM Systems Analysis, Inc: www.skm.com/#sle.

PART 2 PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
1. Materials: Comply with Section 26 0553.
2. Minimum Size: 4 by 6 inches (100 by 150 mm).
3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.

a. Include the following information:
    1) Arc flash boundary.
    2) Available incident energy and corresponding working distance.
    3) Nominal system voltage.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 0553.

3.2 FIELD QUALITY CONTROL

A. Adjust equipment and protective devices for compliance with studies and recommended settings.

END OF SECTION 26 0573

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Occupancy sensors.

B. Accessories.

1.2 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

E. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

F. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of lighting control devices with millwork, furniture, equipment and other potential conflicts.
   2. Coordinate placement of occupancy sensors with millwork, furniture, equipment and other potential obstructions to motion detection coverage.
   3. Coordinate lighting control device product selections with luminaire characteristics; see Section 26 5100 and lighting fixture schedule.
   4. Notify Architect of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install lighting control devices until final surface finishes and painting are complete.

1.4 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Product Data: Include ratings, operating modes or sequence of functions, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
   2. Provide the above overlaid on the reflected ceiling plan. Provide complete wiring diagrams showing the entire installation specific to the project. Provide compatibility documentation relating to ballast, lamp, fixture, other controls. control wiring, and other sensors.
      a. The Engineers' stamped/sealed drawings are not to be submitted as shop drawings. The contractor and their lighting control supplier shall prepare electronic drawings with a titleblock associated with the manufacturer/supplier.

D. Field quality control reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.7 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.8 WARRANTY

A. See Division 1 for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.2 OCCUPANCY SENSORS

A. Manufacturers:
   1. Lutron, Leviton, Hubbell Building Automation, Wattstopper/Legrand, Sensor Switch, Steinel, nLight, or approved equal.
   2. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. All sensors shall have an auxiliary contact for HVAC notification.
   3. Sensor Technology:
      a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
      b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
      c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
   4. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   5. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   6. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.

8. Sensitivity: Field adjustable.
9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
10. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
11. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

C. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
   a. Description: Low profile occupancy sensors designed for ceiling installation.
   b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
   c. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
   d. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 square meters) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
   b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet (111.5 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
3. Ultrasonic Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet (46.5 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
   b. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet (92.9 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
      1) Products:
   c. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet (185.8 sq m) at a mounting height of 9 feet (2.7 m).
      1) Products:
4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
   b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet (111.5 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.

D. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control the load indicated on drawings.

E. Low-voltage push buttons
1. Where indicated on the drawings, provide low-voltage push button devices Listed as compatible with the manufacturer/model of occupancy sensor installed.
2. Low-voltage push buttons shall have separate buttons for:
   a. On
   b. Off
   c. Raise
   d. Lower

F. Accessories:

1. Provide heavy duty coated steel wire protective guards compatible with specified occupancy sensors where indicated.

2.3 **CONTROL ACCESSORIES**

A. Auxiliary Contacts:
   1. Comply with NEMA ICS 5.
   2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.

B. Pilot Devices:
   1. Comply with NEMA ICS 5; heavy-duty type.
   2. Nominal Size: 30 mm.
   3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
   4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
   5. Indicating Lights: Push-to-test type unless otherwise indicated.
   6. Provide LED lamp source for indicating lights and illuminated devices.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130 including mounting heights specified in those standards unless otherwise indicated.

B. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

C. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.
   1. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   2. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

D. Install lighting control devices in accordance with manufacturer's instructions.

E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

F. Install lighting control devices plumb and level, and held securely in place.

G. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.

H. Provide required supports in accordance with Section 26 0537 - Boxes.

I. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

J. Identify lighting control devices in accordance with Section 26 0553.

K. Occupancy Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

L. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

M. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.4 FIELD QUALITY CONTROL

A. Inspect each lighting control device for damage and defects.

B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

C. Test low-voltage push buttons for correct operation. Test raise/lower button functions. Adjust deadband setting on all raise/lower buttons to a minimal time (no greater than 1 second).

D. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. All calibrations and adjustments are to be made on-site by factory-authorized personnel. Provide logs as part of the submittal.

C. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

F. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

G. Notify Architect/Engineer 10 days prior to calibration/adjustments.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 **CLOSEOUT ACTIVITIES**

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
   4. Location: At project site.

END OF SECTION 26 0923

SECTION 26 2413 - SWITCHBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

C. Switchboard accessories.

1.2 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.

E. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.

F. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 1000 Volts or Less; 2023.

G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

J. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

K. UL 891 - Switchboards; Current Edition, Including All Revisions.

L. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Division 01 and Section 260010 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation demonstrating selective coordination upon request.

D. Supplier of Switchgear, Panelboards and Fusible Disconnect Switches shall provide a coordination study for short circuit to ensure compliance with NEC requirements. Supplier shall also provide coordination of breaker and fused/shunt trip elevator disconnect to ensure power to the elevator is also coordinated. The Supplier to assume infinite short circuit available at the bus on high side of utility transformer or Supplier shall coordinate directly with Utility Company for actual fault available.

E. Supplier of Switchgear, Panelboards and Fusible Disconnect Switches shall provide an arc flash study in accordance with NFPA 70 and 70E. Contractor shall also provide arc flash labeling of Switchgear, Panelboards and Fusible Disconnect Switches to ensure compliance with NFPA 70 and 70E requirements.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

H. Contractor and Supplier shall ensure that switchboard and all other equipment within the Electrical room can be installed and still maintain NEC required clearances prior to ordering.

1.4 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

D. Suitable for use as Service Entrance Equipment.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

E. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Switchboards:
   1. ABB/GE; : www.geindustrial.com/#sle.
   2. Eaton Corporation: www.eaton.com.
   3. Schneider Electric: www.se.com/#sle.
   4. Siemens Industry, Inc: www.new.siemens.com/#sle.
   5. Source Limitations: Provide switchboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.2 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Front-Connected Switchboards:
   1. Main Device(s): Individually-mounted.
   2. Feeder Devices: Panel/group-mounted.
   3. Arrangement: Front accessible only (not rear accessible), rear aligned.
   4. Gutter Access: Bolted covers.

E. Service Entrance Switchboards:
   1. Listed and labeled as suitable for use as service equipment according to UL 869A.
   2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
   3. Comply with Utility Company requirements for electrical service.

F. Service Conditions:
   1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
      a. Altitude: Less than 6,600 feet (2,000 m).
      b. Ambient Temperature:
         1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
   2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

G. Short Circuit Current Rating:
   1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

H. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

I. Bussing: Sized in accordance with UL 891 temperature rise requirements.
   1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
   2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Phase and Neutral Bus Material: Aluminum or copper.
   5. Ground Bus Material: Aluminum or copper.

J. Conductor Terminations: Suitable for use with the conductors to be installed.
   1. Line Conductor Terminations:
      a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
      b. Main and Neutral Lug Type: Mechanical.
   2. Load Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

K. Enclosures:
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
      b. Outdoor Locations: Type 3R.
   2. Finish: Manufacturer's standard unless otherwise indicated.

L. Future Provisions:
   1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

M. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list switchboards as a complete assembly including surge protective device.

N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
      a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
      c. Provide zone selective interlocking capability for all breakers, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

O. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

P. Instrument Transformers:
   1. Comply with IEEE C57.13.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Connect secondaries to shorting terminal blocks.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:
   1. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   2. Molded Case Circuit Breakers:
      a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
         1) Provide electronic trip circuit breakers.
      b. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
         1) Provide the following field-adjustable trip response settings:
            (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
            (b) Long time delay.
            (c) Short time pickup and delay.
            (d) Instantaneous pickup.
            (e) Ground fault pickup and delay where ground fault protection is indicated.
      c. Provide the following features and accessories where indicated or where required to complete installation:
         1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2.4 **POWER METERS**

A. Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
   1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
      a. Phase Currents, Each Phase: Plus or minus 1 percent.
      b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
      c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
      d. Kilowatts: Plus or minus 2 percent.
      e. Kilovars: Plus or minus 2 percent.
      f. Power Factor: Plus or minus 2 percent.
      g. Frequency: Plus or minus 0.5 percent.
      h. Kilowatt Demand: Plus or minus 2 percent; demand interval programmable from 5 to 60 minutes.
      i. Accumulated Energy, Kilowatt Hours: Plus or minus 2 percent.
      j. Accumulated values unaffected by power outages up to 72 hours.

B. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

C. Meter shall be Cutler Hammer IQ Data Plus, Square D Power Logic Power Meter, or GE PQM Digital Meter.
   1. Meter suitable for connection to 3- and 4-wire circuits.
   2. Potential indicating lamps.
   3. Adjustments for light and full load, phase balance, and power factor.
   4. Integral demand indicator.
   5. Removable meter with draw-out test plug.

2.5 SOURCE QUALITY CONTROL

A. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
   1. Dielectric tests.
   2. Mechanical operation tests.
   3. Grounding of instrument transformer cases test.
   4. Electrical operation and control wiring tests, including polarity and sequence tests.
   5. Ground-fault sensing equipment test.

B. Shop inspect and test switchboard according to NEMA PB 2.

PART 3 EXECUTION

3.1 **PREPARATION**

A. Verify that field measurements are as indicated on drawings.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.

D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch (10 mm) between switchboard and wall.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install switchboards plumb and level.

G. Unless otherwise indicated, mount switchboards on properly sized 4 inch (100 mm) high concrete pad constructed in accordance with Section 03 3000.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Install all field-installed devices, components, and accessories.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Provide filler plates to cover unused spaces in switchboards.

L. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.

M. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

N. Install equipment grounding connections for switchboards with ground continuity to main electrical ground bus.

O. Anchor to concrete equipment pad.

P. The Electrical Contractor shall be responsible to provide and install the Arc Fault and SCCR labels to the equipment required by the NEC. This includes, but is not limited to Switchboards, Panelboards, Motor Control Centers, elevators, industrial control panels and industrial machinery. This calculation must be done by a qualified person with experience doing these calculations and must be documented and available to the Engineer for review, if requested.

Q. Provide arc flash warning labels in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

B. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

C. Perform inspections and tests listed in NETA ATS, Section 7.1.

D. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 200 amperes. Tests listed as optional are not required.

E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

F. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are required.

G. Test shunt trips to verify proper operation.

H. Correct deficiencies and replace damaged or defective switchboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

C. Adjust circuit breaker trip and time delay settings to values indicated, or as suggested by manufacturer of equipment being fed.

3.5 CLEANING

A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred surfaces to match original factory finish.

C. On completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 2413

SECTION 26 2416 - PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

E. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

F. NEMA PB 1 - Panelboards; 2011.

G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less; 2023.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

L. UL 67 - Panelboards; Current Edition, Including All Revisions.

M. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

N. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

O. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

P. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

Q. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.4 SUBMITTALS

A. See Section 26 0130 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include wiring diagrams showing all factory and field connections.
   2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

D. Supplier of Switchgear, Panelboards and Fusible Disconnect Switches shall provide a coordination study for short circuit to ensure compliance with NEC requirements. Supplier shall also provide coordination of breaker and fused/shunt trip elevator disconnect to ensure power to the elevator is also coordinated. The Supplier to assume infinite short circuit available at the bus on high side of utility transformer or Supplier shall coordinate directly with Utility Company for actual fault available.

E. Supplier of Switchgear, Panelboards and Fusible Disconnect Switches shall provide an arc flash study in accordance with NFPA 70 and 70E. Contractor shall also provide arc flash labeling of Switchgear, Panelboards and Fusible Disconnect Switches to ensure compliance with NFPA 70 and 70E requirements.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 260010 - GENERAL PROVISIONS, for additional provisions.
   2. Panelboard Keys: Two of each different key.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Siemens Industry, Inc: www.usa.siemens.com.

E. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a single supplier.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet (2,000 m).
2. Ambient Temperature:
    a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

C. Short Circuit Current Rating:
1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. Listed series ratings are not acceptable.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    a. Indoor Clean, Dry Locations: Type 1.
2. Boxes: Galvanized steel unless otherwise indicated.
    a. Provide wiring gutters sized to accommodate the conductors to be installed.
3. Fronts:
    a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.

K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

M. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

N. Load centers are not acceptable.

O. Provide the following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
2. Sub-feed lugs.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. All panels identified on plans as Distribution Panels shall meet these requirements.

C. Shall be Square D I-Line Panelboard or equivalent.

D. Service entrance panels shall be UL listed and bear the UL label "Suitable for use as Service Equipment". Main breaker shall be 100% rated for a service entrance panels 800A or greater.

E. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

F. Bussing:
   1. Phase and Neutral Bus Material: Aluminum or copper.
   2. Ground Bus Material: Aluminum or copper.

G. Circuit Breakers:
   1. Provide bolt-on type.

H. Minimum integrated short circuit rating:
   1. 208 Volt Panelboards: Minimum 22,000 amperes rms symmetrical.

I. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.
   2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

J. Where scheduled, provide integral Surge Protection (SPD), as specified in Section 26 4300.

K. All panels shall have spare space and spare circuit breakers as identified on the drawings or if not identified on the plans provide a minimum, 20% spare space

2.4 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Shall be Square D Type NQ or Type NF depending on voltage or equivalent.

C. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

D. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Aluminum or copper.
   3. Ground Bus Material: Aluminum or copper.

E. Circuit Breakers: Thermal magnetic bolt-on type, with common trip handle for all poles; UL listed unless otherwise indicated.

F. Minimum Integrated Short Circuit Rating:
   1. 208 Volt Panelboards: Minimum 22,000 amperes rms symmetrical.

G. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.

3. Provide clear plastic circuit directory holder mounted on inside of door.

H. Where scheduled, provide integral Surge Protection (SPD), as specified in Section 26 4300.

I. All panels shall have spare space and spare circuit breakers as identified on the drawings or of not identified on the plans provide a minimum, 25% spare circuit breakers & 25% space for future circuit breakers.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
   a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   d. For equipment with GFCI requirements provide GFCI breaker protection for all equipment that is not readily accessible per NEC and local Authority Having Jurisdiction.
8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
11. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.6 SOURCE QUALITY CONTROL

A. See Section 26 0010 - General Provisions, for submittal procedures.

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 3000.

J. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted (recessed) panelboard stubbed into accessible space above ceiling. Identify each as SPARE.

K. Provide grounding and bonding in accordance with Section 26 0526.
   1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
   2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

L. Install all field-installed branch devices, components, and accessories.

M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

O. Provide filler plates to cover unused spaces in panelboards.

P. Identify panelboards in accordance with Section 26 0553.
   1. Provide identification nameplate for each power distribution panelboard branch device in accordance with Section 26 0553, clearly and specifically indicating the loads served.

Q. Provide typed circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces. Revise directory to reflect circuiting changes required to balance phase loads. Hand written directories are not acceptable. Replace existing directories with new updated versions in renovation situations. Directory shall include room numbers.

R. The Electrical Contractor shall be responsible to provide and install the Arc Fault and SCCR labels to the equipment required by the NEC. This includes, but is not limited to Switchboards, Panelboards, Motor Control Centers, elevators, industrial control panels and industrial machinery. This calculation must be done by a qualified person with experience doing these calculations and must be documented and available to the Engineer for review, if requested.

S. Provide arc flash warning labels in accordance with NFPA 70.

T. Ground and bond panelboard enclosure according to Section 26 0526.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 200 amperes. Tests listed as optional are not required.

C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

D. Test GFCI circuit breakers to verify proper operation.

E. Test AFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 2416

SECTION 26 2726 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Occupancy sensors.

C. Receptacles.

D. Wall plates and covers.

1.2 REFERENCE STANDARDS

A. FS W-C-596 .- Connector, Electrical, Power, General Specification for; Revision G, 2001

B. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

C. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

F. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

G. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

J. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

K. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

L. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.4 SUBMITTALS

A. See Section 26 0010 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Shop Drawings: Required.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

B. Products listed and classified by Underwriters Laboratories Inc.as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 **WIRING DEVICE APPLICATIONS**

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. The contractor is responsible for providing (furnishing and installing) Ground Fault Circuit Interruptor (GFCI) protection in compliance with Code. In no instance is the contractor permitted to provide (furnish and install) in such a manner that is not in compliance with Code unless specifically documented by the Authority Having Jurisdiction (AHJ). GFCI protection shall be provided where required by Code, and shall be installed in such a manner such that the installation is in compliance with Code. This appliance to attributes such as but not limited to the test/reset function being installed so it is readily accessible. It shall be the responsibility of the contractor to confirm with all trades and equipment that such installation will result in the test/reset functions being installed as readily accessible.

D. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

E. Provide tamper resistant receptacles for receptacles installed in dwelling units.

F. Provide GFCI protection for receptacles serving electric drinking fountains.

G. Provide GFCI protection for receptacles installed in kitchens/concessions or similar spaces.

H. Provide GFCI protection for receptacles installed within 6 feet (1.8 m) of sinks.

I. Provide isolated ground receptacles for receptacles serving computers.

J. Unless otherwise noted, do not use combination switch/receptacle devices.

K. For flush service fittings, use tile rings for installations in tile floors.

L. For flush floor service fittings, use carpet flanges for installation in carpeted floors.

2.2 **MANUFACTURERS**

A. Hubbell: www.hubbell.com.

B. Cooper/Arrow Hart: www.cooperindustries.com.

C. Legrand - Pass & Seymour

D. Leviton: www.leviton.com.

E. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.3 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: Gray with stainless steel wall plate.

2.4 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.5 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com.
   3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.
   3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.
      a. Provide hospital-grade receptacles in the Nursing Lab and in all rooms labeled Patient Room.
   4. Provide labeling of receptacles as outlined in Section 26 0553.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
      a. For devices located behind equipment such as, but not limited to refrigerators, freezers, lab equipment, sump pumps, etc. provide a GFI with an audible alarm.
      b. Provide in all locations as required by NEC.
   2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
   3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. Special purpose receptacles, as noted or shown on drawings.

2.6 WALL PLATES

A. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

C. In-Use Weatherproof Cover Plates: Self-closing and weatherproof with cord and plug inserted into device. Product Hubbell WP26MH or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Connect wiring device grounding terminal to outlet box with bonding jumper, except where equipment grounding conductor is present.

H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

J. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

K. Install wiring devices plumb and level with mounting yoke held rigidly in place.

L. Install wall switches with OFF position down.

M. Mount grouped devices in a single continuous gang box. Use partitions where voltage between exposed live parts of adjacent switched may exceed 300 volts.

N. Provide single coverplate for multi-gang boxes for switches shown grouped on the drawings.

O. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on left.

P. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

Q. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

R. Identify wiring devices in accordance with Section 26 0553.

S. For equipment with GFCI requirements provide GFCI breaker protection for all equipment that is not readily accessible per NEC and local Authority Having Jurisdiction.

T. Install receptacles with grounding pole oriented to the top.

U. Install suspended outlet assembly in accordance with detail shown on drawings.

V. Use jumbo size plates for outlets installed in masonry walls.

W. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

X. Install protective rings on active flush cover service fittings.

3.4 FIELD QUALITY CONTROL

A. See Section 260010 - GENERAL PROVISIONS, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Perform field inspection in accordance with Quality Requirements.

D. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

E. Verify that each receptacle device is energized.

F. Test each receptacle to verify operation and proper polarity.

G. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

H. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust devices and boxes as required to assure that device coverplates seat firmly to wal surface.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 2726

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

1.2 REFERENCE STANDARDS

A. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

B. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

C. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources ; 2021.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.4 SUBMITTALS

A. See Section 26 0010 - General Provisions for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings,

service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.
   b. Include IES LM-79 test report upon request.
2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

E. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Products listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. All luminaires shall be provided with a disconnecting means meeting the requirements of the NEC.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.3 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Sealed maintenance-free nickel cadmium unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

G. Accessories:
   1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
   2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   3. Provide compatible accessory wire guards where indicated.
   4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.4 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single- or double-face as indicated or as required for installed location.
   2. Directional Arrows: As indicated or as required for installed location.

B. Accessories:
   1. Provide compatible accessory high-impact polycarbonate vandal shields where indicated.
   2. Provide compatible accessory wire guards where indicated.

2.5 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to one percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.6 ACCESSORIES

A. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

H. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
   4. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
   5. Install clips to secure recessed grid-supported luminaires in place.

I. Support luminaires independent of ceiling frame.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

M. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test emergency lighting units, self-powered exit signs, and emergency lighting control units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 5100

SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires.

B. Poles and accessories.

C. Luminaire accessories.

1.2 REFERENCE STANDARDS

A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals; 2013, with Editorial Revision (2022).

B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2023.

C. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

D. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

E. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

F. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

G. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources ; 2021.

H. IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities; 2022.

I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

J. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 1598 - Luminaires; Current Edition, Including All Revisions.

N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.4 SUBMITTALS

A. See Division 1 and Section 260010 for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

E. Field Quality Control Reports.
   1. Include test report indicating measured illumination levels.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 26 0010 - General Provisions, for additional information.

I. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

C. Protect installed luminaires from subsequent construction operations.

1.7 WARRANTY

A. See Section 26 0010 - General Provisions, for additional warranty requirements.

B. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

I. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

J. Exposed Hardware: Stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

H. Install accessories furnished with each luminaire.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

3.4 FIELD QUALITY CONTROL

A. See Section 01 and 26 0010 for additional requirements.

B. Inspect each product for damage and defects.

C. Perform field inspection, testing, and adjusting in accordance with manufacturer's instructions.

D. Operate each luminaire after installation and connection to verify proper operation.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.6 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.7 CLOSEOUT ACTIVITIES

A. Just prior to Substantial Completion, replace all lamps that have failed. Relamping shall not come from Owner spare stock.

END OF SECTION 26 5600

SECTION 27 1000 - STRUCTURED CABLING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Fiber optic cable and interconnecting devices.

E. Communications equipment room fittings.

F. Communications outlets.

G. Communications grounding and bonding.

H. Communications identification.

1.2 REFERENCE STANDARDS

A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

B. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; 2005e.

C. ICEA S-83-596 - Indoor Optical Fiber Cable; 2021.

D. ICEA S-90-661 - Category 3 and 5E Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for Use in General Purpose and LAN Communication Wiring Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 1988a (Reaffirmed 2012).

G. TIA-492AAAC - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.

H. TIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 Edition 2: Fibre-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement; 2015a (Reaffirmed 2022).

I. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; IEC 61280-4.1 Edition 3.1, Fiber Optic Communications Subsystem Test Procedures- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement; 2023d.

J. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2024.

K. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2018d, with Addenda (2020).

L. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2022e.

M. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

N. TIA-598 - Optical Fiber Cable Color Coding; 2014d, with Addendum (2018).

O. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.

P. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d, with Addendum (2021).

Q. UL 444 - Communications Cables; Current Edition, Including All Revisions.

R. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

S. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

T. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
   3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Technician.

D. Evidence of qualifications for installer.

E. Field Test Reports.

F. Project Record Documents: Prepared and approved by BICSI Registered Technician.
   1. Record actual locations of outlet boxes and distribution frames.
   2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
   3. Identify distribution frames and equipment rooms by room number on drawings.

G. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
   1. Supervisors and installers factory certified by manufacturers of products to be installed.
   2. Employing BICSI Registered Cabling Installation Technicians (RCIT) for supervision of all work.

1.6 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cabling and Equipment:
   1. Hubbell Berk tek, Hitachi, Panduit, Belden, Mohawk, Commscope, Allen Tel, Signamax, and Comtran Cable.

2.2 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
   1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).

2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F (0 to 60 degrees C) at relative humidity of 0 to 95 percent, noncondensing.
4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.
1. Locate main distribution frame as indicated on the drawings.

C. Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to telecommunications outlets.
1. Locate intermediate distribution frames as indicated on the drawings.

D. Backbone Cabling: Cabling, pathways, and terminal hardware connecting intermediate distribution frames (IDF's) with main distribution frame (MDF), wired in star topology with main distribution frame at center hub of star.

E. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.3 PATHWAYS

A. Conduit: See section 27 0533.13.

B. Conduit shall be 1" minimum at all locations unless noted otherwise.

C. Cable Trays: See Section 26 0536.

D. Underground Service Entrance: Rigid polyvinyl chloride (PVC) conduit, Schedule 40.

2.4 COPPER CABLE AND TERMINATIONS

A. Provide cables with lead content less than 300 parts per million.

B. Copper Backbone Cable:
1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2, ICEA S-90-661, and listed and labeled as complying with UL 444; arranged in 25-pair binder groups.
2. Cable Type: TIA-568.2 Category 3 UTP (unshielded twisted pair); 24 AWG.
3. Cable Capacity: Quantity of pairs as indicated on drawings.
4. Cable Applications:
   a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
   b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.

C. Copper Horizontal Cable:
1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
2. Cable Type - Voice and Data: TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
3. Cable Capacity: 4-pair.
4. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.
5. Cable Jacket Color -Data Cable: Blue.
6. Cable Jacket Color - Voice Cable: Yellow.

D. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

E. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
1. Performance: 500 mating cycles.

2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

2.5 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

A. Fiber Optic Backbone Cable:
1. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568.3, TIA-598, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
2. Cable Type: Multimode, laser-optimized 50/125 um (OM3) complying with TIA-492AAAC.
3. Cable Capacity: Quantity of fibers as indicated on drawings.
4. Cable Applications:
5. Cable Jacket Color:
a. Laser-Optimized Multimode Fiber (OM3/OM4): Aqua.
b. Single-Mode Fiber (OS1/OS2): Yellow.

B. Fiber Optic Interconnecting Devices:
1. Connector Type: Type SC.
2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
3. Maximum Attenuation/Insertion Loss: 0.3 dB.

2.6 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:
1. Connector Blocks for Category 5e and Up Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.
2. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch (482.6 mm) wide equipment racks; 0.09 inch (2.2 mm) thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
d. Provide incoming cable strain relief and routing guides on back of panel.

B. Fiber Optic Cross-Connection Equipment:
1. Patch Panels for Fiber Optic Cabling: Sized to fit EIA/ECA-310 standard 19 inch (482.6 mm) wide equipment racks; 0.09 inch (2.2 mm) thick aluminum.
a. Adapters: As specified above under FIBER OPTIC CABLE AND INTERCONNECTING DEVICES; maximum of 24 duplex adaptors per standard panel width.
b. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
c. Provide incoming cable strain relief and routing guides on back of panel.
d. Provide rear cable management tray at least 8 inches (203 mm) deep with removable cover.
e. Provide dust covers for unused adapters.

C. Backboards: Interior grade plywood without voids, 3/4 inch (19 mm) thick; UL-labeled fire-retardant.
1. Do not paint over UL label.

D. Equipment Frames, Racks and Cabinets:
1. Component Racks: EIA/ECA-310 standard 19 inch (482.6 mm) wide.
2. Floor Mounted Racks: Aluminum or steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.

2.7 COMMUNICATIONS OUTLETS

A. Outlet Boxes: Comply with Section 26 0533.16.

1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
2. Minimum Size, Unless Otherwise Indicated:
    a. Voice Only Outlets: 4 inch by 2 inch by 2-1/8 inch deep (100 by 50 by 54 mm) trade size.
    b. Data or Combination Voice/Data Outlets: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
    c. Provide single gang mud ring unless otherwise noted.

B. Wall Plates:
1. Comply with system design standards and UL 514C.
2. Accepts modular jacks/inserts.
3. Capacity:
    a. Voice Only Outlets: 2 ports.
    b. Data or Combination Voice/Data Outlets: 4 ports.
4. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified in Section 26 2726.

2.8 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607.

B. Comply with Section 26 0526.

2.9 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

B. Comply with Section 26 0553.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 26 0010.

3.2 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:
1. 48 inches (1220 mm) from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
2. 12 inches (300 mm) from power conduits and cables and panelboards.
3. 5 inches (125 mm) from fluorescent and high frequency lighting fixtures.
4. 6 inches (150 mm) from flues, hot water pipes, and steam pipes.

B. Outlet Boxes:
1. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of telecommunications outlets provided under this section.

3.3 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
2. Do not over-cinch or crush cables.
3. Do not exceed manufacturer's recommended cable pull tension.

4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
5. The use of plenum-rated cable is permitted where installed above an accessible ceiling. Cable shall be installed in conduit where concealed within walls and in locations where the cable is otherwise exposed. All conduits shall stub to the nearest accessible ceiling space. Where cable is not instlaled in conduit, the cable shall be supported by means of j-hooks, D-rings, or other Listed means. Cable shall be bundled using Velcro straps. The use of plastic wire ties/zip ties is prohibited. Cable shall be installed independently of all other wiring systems. Cables shall be routed perpendicular and parallel to the building construction.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
1. At Distribution Frames: 120 inches (3000 mm).
2. At Outlets - Copper: 12 inches (305 mm).
3. At Outlets - Optical Fiber: 39 inches (1000 mm).

C. Copper Cabling:
1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch (12 mm) from point of termination.
2. For 4-pair cables in conduit, do not exceed 25 pounds (110 N) pull tension.
3. Use T568B wiring configuration.

D. Fiber Optic Cabling:
1. Prepare for pulling by cutting outer jacket for 10 inches (250 mm) from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
2. Support vertical cable at intervals as recommended by manufacturer.

E. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.

F. Identification:
1. Use wire and cable markers to identify cables at each end.
2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

3.4 FIELD QUALITY CONTROL

A. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:
1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.

C. Testing - Copper Cabling and Associated Equipment:
1. Test backbone cables after termination but before cross-connection.
2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
3. Test operation of shorting bars in connection blocks.
4. Category 3 Backbone: Perform attenuation test.
5. Category 3 Links: Test each pair for short circuit continuity, short to ground, crosses, reversed polarity, operational and ring-back, and dial tone.
6. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.
7. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

D. Testing - Fiber Optic Cabling:

1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.
2. Multimode Backbone: Perform tests in accordance with TIA-526-14.
3. Single Mode Backbone: Perform tests in accordance with TIA-526-7.
4. Links: Perform optical fiber end-to-end attenuation tests and field reel tests.

E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION 27 1000

SECTION 28 4600 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

1.2 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

F. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

A. Evidence of designer qualifications if requested by the engineer.

B. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:

1. Copy (if any) of list of data required by authority having jurisdiction.
2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
4. System zone boundaries and interfaces to fire safety systems.
5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
7. List of all devices on each signaling line circuit, with spare capacity indicated.
8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
12. Certification by Contractor that the system design complies with Contract Documents.
13. Do not show existing components to be removed.

C. Evidence of installer qualifications fi requested by the engineer.

D. Evidence of instructor qualifications; training lesson plan outline.

E. Evidence of maintenance contractor qualifications, if different from installer.

F. Inspection and Test Reports:

1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

G. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

H. Project Record Documents: See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

I. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Certificate of Occupancy.

J. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data.

1.4 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
4. Contract maintenance office located within 175 miles (282 km) of project site.
5. Certified in the State in which the Project is located as fire alarm installer.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

1.5 WARRANTY

A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Alarm Control Units and Accessories - Basis of Design: Provide an extension to the existing Siemens addressable fire alarm system currently installed in the facility. No substitutions..

2.2 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide modifications and extensions to the existing Siemens automatic fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. ADA Standards.
      b. The requirements of the State Fire Marshal.
      c. The requirements of the local authority having jurisdiction.
      d. Applicable local codes.
      e. Contract Documents (drawings and specifications).
      f. NFPA 101.
      g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
   4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
   5. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones..
   6. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.

B. Supervising Stations and Fire Department Connections:
   1. Public Fire Department Notification: By on-premises supervising station.
   2. On-Premises Supervising Station: Existing.
   3. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.

C. Circuits:
   1. Initiating Device Circuits (IDC): Class B.
   2. Signaling Line Circuits (SLC)[]: Class B.
   3. Notification Appliance Circuits (NAC): Class B.

D. Spare Capacity:
   1. Initiating Device Circuits: Minimum 25 percent spare capacity.
   2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
   3. Speaker Amplifiers: Minimum 25 percent spare capacity.
   4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
   1. Primary: Dedicated branch circuits of the facility power distribution system.
   2. Secondary: Storage batteries.
   3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
   4. Each Computer System: Provide uninterruptible power supply (UPS).

2.3 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into the existing system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.

B. Clearly label components that are "Not In Service."

C. Remove unused existing components and materials from site and dispose of properly.

2.4 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
   1. Sprinkler water control valves.
   2. Dry-pipe sprinkler system pressure.
   3. Dry-pipe sprinkler valve room low temperature.
   4. Elevator shut-down control circuits.
   5. Post Indicating Valve (PIV).

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
   1. Sprinkler water flow.
   2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
   3. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.

C. Elevators:
   1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
   2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
   3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
   1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
   2. Connections to Building Automation System for Alarm, Trouble, and Supervisory.

E. Doors:
   1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
   2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 7100.
   3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 3323.

2.5 COMPONENTS

A. General:
   1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
   2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Initiating Devices:
   1. Manual Pull Stations:
      a. A double action type, red LEXAN or metal, and finished in red with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control unit.
      b. No break glass type - exterior or interior to unit shall be allowed.
   2. Smoke Detectors: []
      a. Smoke sensors shall be of the photoelectric type. Each sensor head shall contain an LED that will flash each time it is scanned by the Control Unit. In alarm condition, the sensor head LED shall be on steady.
      b. For residential, multi-family, dormitories spaces, etc. provide dual detection smoke detectors - both ionization and photoelectric.
   3. Duct Smoke Detectors: []
      a. Photoelectric type with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for mechanical equipment shutdown. Duct housing shall provide two (2) test ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
      b. Each duct detector sensor shall have a remote test station with an alarm LED and test switch.
   4. Heat Detectors: []
      a. Thermal sensor: Combination fixed-temperature and rate of rise unit with plug in base and alarm indication lamp; 135 deg F fixed temperature setting except as indicated. Sensor fixed temperature sensing shall be independent of the rate of rise sensing and programmable to operate at 135 deg F or 155 deg F. Sensor rate of rise temperature detection shall be selectable at the FACP for either 15 deg F or 20 deg F per minute. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32 deg F to 155 deg F.
   5. Addressable Interface Devices: []
      a. As required to provide addresses to all monitored points.

C. Notification Appliances:
   1. Combination Audio/Visual (Horn/Strobe):
      a. Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings.
   2. Strobe: []
      a. Visible/Only (V/O): Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different selectable minimum flash intensities of 15cd, 75cd and 110cd on each device. Provide a label inside the strobe lens to indicate the listed candela rating of the specific V/O appliance.
   3. Horn:
      a. Piezoelectric type horn shall be listed to UL 464. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The horn shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings.

D. Circuit Conductors: Copper or optical fiber; provide 200 feet (60 m) extra; color code and label.

E. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

F. Locks and Keys: Deliver keys to Owner.

G. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
   1. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

E. All fire alarm wiring shall be installed in conduit.
   1. All conduit shall be red in color.

F. Provide dust covers until site is ready for testing and final cleaning has been done.

G. Provide red label for FACP Over Current Protective Device (OCPD).

H. Provide label on FACP for location, panel, and circuit number for FACP OCPD.

I. Smoke detectors shall be a minimum 3' from supply and return diffusers, coordinate with mechanical contractor.

J. The use of plenum rated fire alarm cable is permitted where installed above an accessible ceiling. Fire alarm cable shall be installed in conduit where concealed within walls and in locations where the cable is otherwise exposed. All conduits shall stub to the nearest accessible ceiling space. Where cable is not installed in conduit, it shall be supported (i.e. j-hooks or similiar supported from the building structure or wall). Fire alarm cable shall be bundled using Velco straps. The use of plastic wire ties/zip ties is prohibited. Fire alarm cable shall be installed independently to all other wiring systems. Cables shall be routed perpendicular and parallel to the building construction. Where cables must penetrate non-rated wall assemblies the contractor shall install conduit sleeves with insulating bushings. Cables shall not be draped across building structure, ductwork, piping, conduit, or any other system. Where cables penetrate rated walls the contractor shall provide Listed penetration devices such as but not limited to STI E-Z-Path or equal with capacity for a minimum of 25% future expansion.

3.2 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.3 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.

B. Basic Operation: one - two hour session for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

C. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.4 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Approved operating and maintenance data has been delivered.
   2. Spare parts, extra materials, and tools have been delivered.
   3. All aspects of operation have been demonstrated to Owner.
   4. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   5. Occupancy permit has been granted.
   6. Specified pre-closeout instruction is complete.

3.5 MAINTENANCE

A. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

B. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

C. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

D. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

E. Comply with Owner's requirements for access to facility and security.

END OF SECTION 28 4600