SECTION 00 01 00

TITLE PAGE

ARCHITECT

WALLACE ARCHITECTS, LLC

302 CAMPUSVIEW DRIVE, SUITE 208
COLUMBIA, MO 65201
(573) 256-7200

3999 HARBORWALK DRIVE, SUITE D
RIDGELAND, MS 39157
(601) 813-9154

SIGNATURE AREA

ARCHITECT: Wallace Architects, LLC
302 Campusview Drive, Suite 208, Columbia, MO 65201
By:_____ Title:_____ Date:_____

OWNER: Dashwood Trails, LP
3556 S. Culpepper Circle, Suite 4**,** Springfield, MO 65804
By:_____ Title:_____ Date:_____

CONTRACTOR: Hamilton Builders Contracting, LLC
3556 S. Culpepper Circle, Suite 4, Springfield, MO 65804
By:_____ Title:_____ Date:_____

Wallace Project No. 4809 TDHCA # 24-221

10/25/2024

Dashwood Trails
Houston, Texas

ISSUE SET

SECTION 00 01 09

ADDENDA AS ISSUED

DOCUMENTS

1.01 WHEN APPLICABLE TO THIS CONTRACT, ATTACHED FOLLOWING THIS PAGE IS:

ADDENDA

ADDENDUM #:	**DATE:**	**DESCRIPTION:**

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INVITATION FOR SUB-CONTRACT BIDS

ISSUED BY:

Hamilton Builders Contracting, LLC

Address:

3556 S. Culpepper Circle, Suite 4
Springfield, MO 65804

DATE: _____

TO: POTENTIAL BIDDERS

Your firm is invited to submit a Stipulated Sum proposal under seal to furnish all labor, materials, and equipment necessary to perform the work of the appropriate bid packagefor the construction work of:
Dashwood Trails
12020 Dashwood Drive
Houston, Texas 77072

Bid Documents may be obtained by contacting Hamilton Builders Contracting, LLC.

Submit your offer on the Bid Form provided. Bidders may supplement this form as appropriate.

No proposals may be withdrawn for a period of 30 days after scheduled closing date for submission.

The Contractor reserves the right to reject any or all proposals, and/or waive any technicalities therein, and/or determine the lowest resposible bidders.

As a precondition to the contract award, the type of work completed, and the bidders' financial status will be reviewed and considered.

SIGNATURE

For: Hamilton Builders Contracting, LLC

By: _____

Signed: _____
(Authorized signing officer)

END OF SECTION

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

SUMMARY

1.01 DOCUMENT INCLUDES

A. Invitation
   1. Bid Submission
   2. Intent
   3. Work Identified in Contract Documents

B. Bid Documents and Contract Documents
   1. Definitions
   2. Contract Documents Identification
   3. Availability
   4. Examination
   5. Inquiries/Addenda
   6. Product/Assembly/System Substitutions

C. Site Assessment
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E. Bid Submission
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   2. Selection and Award of Alternates

G. Offer Acceptance/Rejection
   1. Duration of Offer
   2. Acceptance of Offer

INVITATION

2.01 BID SUBMISSION

A. Bid submission details can be found in the invitation to bid.

B. Amendments to the submitted offer will be permitted if received in writing prior to bid closing and if endorsed by the same party or parties who signed and sealed the offer.

2.02 INTENT

A. The intent of this Bid request is to obtain an offer to perform work to complete a multi-family residential renovation project located at 12020 Dashwood Drive , Houston, Texas 77072 for a Stipulated Sum contract, in accordance with the Contract Documents.

2.03 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

A. Work of this proposed Contract comprises building construction and site development, including demolition, general construction, mechanical, electrical, and civil Work.

2.04 CONTRACT TIME

A. Identify Contract Time in the Bid Form. The completion date in the Agreement shall be the Contract Time added to the commencement date.

BID DOCUMENTS AND CONTRACT DOCUMENTS

3.01 DEFINITIONS

A. Contract Documents: Defined in AIA A201 Article 1 including issued Instructions and Addenda.

B. Bid, Offer, Proposal, or Bidding: Act of submitting an offer under seal.

C. Bid Amount: Monetary sum identified by the Bidder in the Bid Form.

3.02 CONTRACT DOCUMENTS IDENTIFICATION

A. Contract Documents are identified as Project Number 4809, as prepared by Wallace Architects, LLC, and with contents as identified in the Table of Contents.

3.03 AVAILABILITY

A. Bid Documents may be obtained by contacting Hamilton Builders Contracting, LLC

B. Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not grant a license for other purposes.

3.04 EXAMINATION

A. Bid Documents may also be viewed, by appointment only, at the office of the Architect which is located at 302 Campusview Drive, Columbia, MO 65201.

B. Upon receipt of Bid Documents verify that documents are complete. Notify Architect should the documents be incomplete.

C. Immediately notify Architect upon finding discrepancies or omissions in the Bid Documents.

3.05 INQUIRIES/ADDENDA

A. Written Instructions and Addenda may be issued during the bidding period. All Instructions and Addenda become part of Contract Documents. Include resultant costs in the Bid Amount.

B. Verbal answers are not binding on any party.

C. Clarifications requested by bidders must be in writing not less than 7 days before date set for receipt of bids. The reply will be in the form of written Instructions or an Addendum, a copy of which will be forwarded to known recipients and all other bidding parties.

3.06 PRODUCT/ASSEMBLY/SYSTEM SUBSTITUTIONS

A. General Requirements for Substitution Requests:
   1. Provide sufficient information to determine acceptability of proposed substitutions.
   2. Provide complete information on required revisions to other work to accommodate each proposed substitution.

B. Substitution Request Time Restrictions:
   1. Where the Bid Documents stipulate a particular product, substitutions will be considered up to 5 days before receipt of bids.

C. Review and Acceptance of Request:
   1. Architect may approve the proposed substitution and will issue an Addendum to known bidders.
   2. For approved substitutions, include representation of changes in the bid, if any, required in the work and changes to Contract Time and Contract Sum to accommodate such substitutions. A later claim by the bidder for an addition to the Contract Time or Contract Sum because of changes in work necessitated by use of substitutions will not be considered.

SITE ASSESSMENT

4.01 SITE EXAMINATION

A. Examine the project site before submitting a bid.

QUALIFICATIONS

5.01 EVIDENCE OF QUALIFICATIONS

A. To demonstrate qualification for performing the Work of this Contract, bidders may be requested to submit written evidence of financial position, previous experience, and license to work in the State.

BID SUBMISSION

6.01 SUBMISSION PROCEDURE

A. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.

B. Submit one copy of the executed offer on the Bid Forms provided, signed and sealed in a closed opaque envelope, clearly identified with bidder's name, project name and Contractor's name on the outside.

C. Improperly completed information or irregularities in bid bond, may be cause not to open the Bid Form envelope and declare the bid invalid or informal.

6.02 BID INELIGIBILITY

A. Bids that are received verbally, by telephone, or facsimile shall be declared unacceptable.

B. Bids containing alternate proposals of bidder's own choosing, not previously approved, shall be declared unacceptable.

C. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, unexplained erasures or alterations, or irregularities of any kind, may at the discretion of the Contractor, be declared unacceptable.

D. Bid Forms, Appendices, and enclosures that are improperly prepared may, at the discretion of Contractor, be declared unacceptable.

BID ENCLOSURES/REQUIREMENTS

7.01 INSURANCE

A. Provide an executed "Undertaking of Insurance" on a standard form provided by the insurance company stating their intention to provide insurance to the bidder in accordance with the insurance requirements of Contract Documents.

7.02 BID FORM REQUIREMENTS

A. Complete all requested information in the Bid Form and Appendices.

7.03 BID FORM SIGNATURE

A. The Bid Form shall be signed by the bidder, as follows:
   1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature.
   2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature.
   3. Corporation: Signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the bid is signed by officials other than the president and secretary of the company, or the president/secretary/treasurer of the company, a copy of the by-law resolution of their board of directors authorizing them to do so, must also be submitted with the Bid Form in the bid envelope.
   4. The signature of the individual or individuals authorized to bind the Bidder shall be in longhand.

7.04 SELECTION AND AWARD OF ALTERNATES

A. Indicate variation of bid price for Alternates listed on the Bid Form. Unless otherwise indicated, indicate Alternatives as a difference in bid price by adding to or deducting from the base bid price.

B. Bids will be evaluated on the total of the base bid price and all of the Alternates. After determination of the successful bidder, consideration will be given to which Alternates will be included in the Work.

OFFER ACCEPTANCE/REJECTION

8.01 DURATION OF OFFER

A. Bids shall remain open to acceptance and shall be irrevocable for a period of thirty (30) days after the bid closing date.

B. Alternates shall remain open to acceptance and prices stipulated shall be irrevocable for a period of ninety (90) days after the bid closing date.

8.02 ACCEPTANCE OF OFFER

A. Contractor reserves the right to accept or reject any or all offers or to waive any technicalities therein.

B. After acceptance by Contractor, Contractor, will issue to the successful bidder, a written Bid Acceptance.

END OF SECTION

BID FORM FOR SUB-CONTRACT

FOR _____

Bid From:_____

a Corporation organized and existing under the Laws of the State of _____

a Partnership consisting of_____

an Individual trading as _____

The Undersigned, in compliance with the Invitation For Sub-Contract Bids for the construction work of Dashwood Trails, Houston, Texas, having examined all of the Contract Documents and any related documents, and having viewed the site of the proposed work, being familiar with all of the conditions surrounding the construction of the proposed project, including the availability of labor; Hereby propose to furnish labor, equipment, materials, and supplies to perform the work in accordance with said Contract Documents, within the time set forth herein, and at the prices stated below. These prices are to cover all expenses included in performing the work received under the Contract Documents, of which this Proposal is part.

I (We) acknowledge receipt of the following Addenda: (if none issued, leave blank or write "N/A")

Addendum #1_____ Addendum #2_____ Addendum #3_____

Addendum #4_____ Addendum #5_____ Addendum #6_____

The undersigned proposes and agrees to perform the _____ work
(Portion of Work)
in_____ calendar days from the issuance of a Notice To Proceed,

for the combined stipulated sum of: _____

_____Dollars $_____

In submitting this bid it is understood that the right is reserved by said Contractor to reject any or all bids, and it is agreed that this bid shall remain open to acceptance and shall be irrevocable for a period of thirty (30) days after opening thereof.

Dated this:_____ day of _____, 2024.

Signature(s)

_____

By:_____

Title:_____

_____
Business Address

SEAL:
(If bid is by a Corporation)

State License No._____

SECTION 00 52 01

STANDARD AGREEMENT BETWEEN OWNER AND CONTRACTOR - AIA DOCUMENT A101-2017

DOCUMENTS

1.01 APPLICABLE TO THIS CONTRACT, AND ATTACHED FOLLOWING THIS PAGE IS:

THE AMERICAN INSTITUTE OF ARCHITECTS
DOCUMENT NO. A101
STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR
--STIPULATED SUM--
2017 EDITION

RELATED REQUIREMENTS

2.01 SECTION 00 72 00 - GENERAL CONDITIONS OF THE CONTRACT - AIA A201-2017.

2.02 SECTION 00 73 00 - SUPPLEMENTAL GENERAL CONDITIONS.

SUPPLEMENTARY CONDITIONS

END OF SECTION

AIA® Document A101® – 2017

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

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

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

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

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

Sample

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

The Owner and Contractor agree as follows.

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

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

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

Init.
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2 THE WORK OF THIS CONTRACT

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4 CONTRACT SUM

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7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

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

ARTICLE 2 THE WORK OF THIS CONTRACT

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

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

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

[ ] The date of this Agreement.

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

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

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

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

§ 3.3 Substantial Completion

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

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

[ ] By the following date:

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

Portion of Work	Substantial Completion Date

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

ARTICLE 4 CONTRACT SUM

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

§ 4.2 Alternates

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

Item	Price

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

Item	Price	Conditions for Acceptance

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

Item	Price

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

Item	Units and Limitations	Price per Unit ($0.00)

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

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

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ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

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

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

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

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

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

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

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

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

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

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

§ 5.1.7 Retainage

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

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

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

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

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

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

§ 5.2 Final Payment

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

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

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

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

§ 5.3 Interest

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

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

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

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§ 6.2 Binding Dispute Resolution

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

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

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

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

ARTICLE 7 TERMINATION OR SUSPENSION

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

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

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

ARTICLE 8 MISCELLANEOUS PROVISIONS

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

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

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

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

§ 8.5 Insurance and Bonds

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

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

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

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

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

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

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

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

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

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

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

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

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

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

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

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

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SECTION 00 61 13

PERFORMANCE AND PAYMENT BOND - AIA DOCUMENT A312-2010

DOCUMENTS

1.01 APPLICABLE TO THIS CONTRACT, AND ATTACHED FOLLOWING THIS PAGE IS:

THE AMERICAN INSTITUTE OF ARCHITECTS
DOCUMENT NO. A312
PERFORMANCE AND PAYMENT BOND
2010 EDITION

AIA® Document A312® – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $ 0.00
Description:
(Name and location)
Sample

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: ☐ None ☐ See Section 16

CONTRACTOR AS PRINCIPAL	**SURETY**
Company: *(Corporate Seal)*	Company: *(Corporate Seal)*
Signature: _____	Signature: _____
Name and Title:	Name and Title:

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

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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

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

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

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

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

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

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

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

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

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

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

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

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

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

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

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

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

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User Notes: (862014838)

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

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

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

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

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

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

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

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

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

§ 14 Definitions

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

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

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

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

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

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

§ 16 Modifications to this bond are as follows:

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

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:	_____	Signature:	_____
Name and Title:		Name and Title:	
Address:		Address:	

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AIA® Document A312® – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $ 0.00
Description:
(Name and location)
Sample

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: ☐ None ☐ See Section 18

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:	_____	Signature:	_____
Name and Title:		Name and Title:	

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

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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

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

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

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

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

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

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

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

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

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

.2 have sent a Claim to the Surety (at the address described in Section 13).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

§ 16 Definitions

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

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

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

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

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

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

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

§ 18 Modifications to this bond are as follows:

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

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:	_____	Signature:	_____
Name and Title:		Name and Title:	
Address:		Address:	

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SECTION 00 72 00

GENERAL CONDITIONS OF THE CONTRACT - AIA DOCUMENT A201-2017

DOCUMENTS

1.01 THE GENERAL CONDITIONS APPLICABLE TO THIS CONTRACT ARE ATTACHED FOLLOWING THIS PAGE.

THE AMERICAN INSTITUTE OF ARCHITECTS
DOCUMENT NO. A201
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION
2017 EDITION

SUPPLEMENTARY CONDITIONS

2.01 SECTION 00 73 00 - SUPPLEMENTAL GENERAL CONDITIONS.

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

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

Dashwood Trails - 4809
Houston, Texas

THE OWNER:
(Name, legal status and address)

Dashwood Trails, LP
3556 S. Culpepper Circle, Suite 4
Springfield, MO 65804

THE ARCHITECT:
(Name, legal status and address)

Wallace Architects, LLC
302 Campusview Drive, Suite 208
Columbia, MO 65201

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes 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 to or deleted from the original AIA text.

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

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™–2017, Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

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

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service or any other information or documentation in digital form.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

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ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

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

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

§ 2.3 Information and Services Required of the Owner

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

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the

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purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

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

§ 3.3 Supervision and Construction Procedures

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

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

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

§ 3.4 Labor and Materials

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

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

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

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§ 3.5 Warranty

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

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

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

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

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct,

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but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

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

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

§ 3.9 Superintendent

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

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

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

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

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

§ 3.11 Documents and Samples at the Site

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

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constructed.

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

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

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The

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

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

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

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

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the

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Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

§ 4.2.4 Communications

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

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

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4.

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

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

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§ 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.

Notwithstanding any provision of this Agreementand any of its amendments to the contrary, Architect has no duty to Owner,Contractor, any of their subcontractors, agents, or assigns or to anyone else to inspect the Work for defects, for lack of quality or for lack of good workmanship. In the event that Architect observes any defects, lack of quality, or lack of good workmanship in the Work while Architect is on site, then Architect will raise the issue with the Owner and Contractor. However, by no means does this provision or the making of such an observation create any duty to inspect for, search out, or find any such defects, lack of quality, or lack of good workmanship. Owner hereby agrees to indemnify and hold harmless, and covenants not to sue, Architect, its owners, employees, contractors, agents, and assigns from any and all claims, demands, costs, expenses, lawsuits, attorney's fees, liability, judgments, and damages which arise or may arise from any defects, lack of quality or lack of workmanship in the Work or the lack of Architect to observe any defects, lack of quality, or lack of workmanship during any site visit or inspections.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

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

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

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but

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rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

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

§ 5.3 Subcontractual Relations

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

§ 5.4 Contingent Assignment of Subcontracts

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

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

§ 6.2 Mutual Responsibility

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

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

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

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

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

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§ 7.2 Change Orders

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

.1 The change in the Work;

.2 The amount of the adjustment, if any, in the Contract Sum; and

.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

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

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

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

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.4.

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

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

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

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

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

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

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

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

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

§ 7.4 Minor Changes in the Work

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

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

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

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

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

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

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

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

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

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the

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Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner that the Work has progressed to the point indicated. Such Certification shall be based on the Architect's limited observations at the site and on the data comprising the Contractor's Application for Payment. 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 ny inspections beyond the monthl y inspection; (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 suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents.

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

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

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

§ 9.6 Progress Payments

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

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

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manner.

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

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

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

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

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

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

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will review the Work 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

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by the Architect. In such case, the Contractor shall then submit a request for another review by the Architect to determine Substantial Completion.

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final review and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such review and, when the Architect finds that final payment is appropriate to make, 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 limited on-site visits and limited inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. However, the issuance of a final Certificate for Payment will not be a representation that the Architect has (1) made any inspections beyond the monthly inspection, (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.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims,

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security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

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

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

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

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

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

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

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in

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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. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

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

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials and Substances

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

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

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

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

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

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

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

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

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

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

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

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

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

§ 11.3 Waivers of Subrogation

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

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

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

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

§11.5 Adjustment and Settlement of Insured Loss

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

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

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the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

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

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

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

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

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

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

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

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

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§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

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

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

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

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

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

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

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

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

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

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

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

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

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.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

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

§ 14.3 Suspension by the Owner for Convenience

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

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

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

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

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

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

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

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

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the

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requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

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

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost

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

§ 15.1.6 Claims for Additional Time

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

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

§ 15.1.7 Waiver of Claims for Consequential Damages

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

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

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

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

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker,

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unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

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

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

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

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

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

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

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

§ 15.3 Mediation

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

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event,

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mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

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

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

§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

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

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Changes to original AIA text

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Any use of, or reliance on, all or a portion of a building information model ~~without agreement to written protocols governing the use of, and reliance on, the information contained in the model~~ shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

PAGE 19

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

PAGE 20

Notwithstanding any provision of this Agreementand any of its amendments to the contrary, Architect has no duty to Owner,Contractor, any of their subcontractors, agents, or assigns or to anyone else to inspect the Work for defects, for lack of quality or for lack of good workmanship. In the event that Architect observes any defects, lack of quality, or lack of good workmanship in the Work while Architect is on site, then Architect will raise the issue with the Owner and Contractor. However, by no means does this provision or the making of such an observation create any duty to inspect for, search out, or find any such defects, lack of quality, or lack of good workmanship. Owner hereby agrees to indemnify and hold harmless, and covenants not to sue, Architect, its owners, employees, contractors, agents, and assigns from any and all claims, demands, costs, expenses, lawsuits, attorney's fees, liability, judgments, and damages which arise or may arise from any defects, lack of quality or lack of workmanship in the Work or the lack of Architect to observe any defects, lack of quality, or lack of workmanship during any site visit or inspections.

PAGE 26

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner~~,~~ ~~based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and~~ that the Work has progressed to the point indicated. Such Certification shall be based on the Architect's limited observations at the site and on the data comprising the Contractor's Application for Payment. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. ~~The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to~~

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~~completion, and to specific qualifications expressed by the Architect.~~ However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made ~~exhaustive or continuous on-site inspections to check the quality or quantity of the Work~~ny inspections beyond the monthl y inspection; (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.

PAGE 27

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will review the Work ~~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 review ~~inspection~~ by the Architect to determine Substantial Completion.

PAGE 28

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final review ~~inspection~~ and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such review and, when the Architect finds that final payment is appropriate to make, the~~inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the~~ Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's limited on-site visits and limited inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. However, the issuance of a final Certificate for Payment will not be a representation that the Architect has (1) made any inspections beyond the monthly inspection, (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.

PAGE 30

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

Variable Information

PAGE 1

Dashwood Trails - 4809

Houston, Texas

Dashwood Trails, LP

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Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 08:12:42 CDT on 10/16/2024 under Order No. 20240027180 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ - 2017, General Conditions of the Contract for Construction, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

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SECTION 00 73 00

SUPPLEMENTAL GENERAL CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

A. These Supplementary Conditions amend and supplement the General Conditions of The Contract For Construction and other provisions Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.

B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

1.02 SUBSTANTIAL COMPLETIONS

A. General:
   1. Partial Substantial Completions may be issued by building or by floor to allow occupancy of a building, or units, and to aid in tax credit purposes. This will be indicated at the pre-construction meeting, if applicable. Partial substantial completions will not establish the starting date for the Contractor's one year latent defects period.
   2. Final Substantial Completion must be issued for the entire project and requires review and approval by Texas Department of Housing and Community Affairs (TDHCA). Final Substantial Completion will establish the starting date for the Contractor's one year latent defects period for the entire project.
   3. The value of incomplete or defective work items listed on the Architect’s Substantial Completion Punchlist shall be determined and included on the Certificate of Substantial Completion. This monetary value shall be escrowed until such time as each respective work item has been completed or corrected to the satisfaction of the Owner, TDHCA, and Architect.

B. Required Documents:
   1. Architect's Punchlist Inspection Report.
   2. Certificate of Occupancy.
   3. Completed AIA Document G704 - Certificate of Substantial Completion.

C. Scheduling:
   1. Scheduling for punchlist inspections and pay request meetings shall coincide to the fullest extent possible for best use of time for all parties involved. The schedule should be followed as presented at the pre-construction meeting. However, in the event the schedule must change, such changes shall be made known and coordinated by the Contractor and Architect with TDHCA.

1.03 RETAINAGE:

A. General:
   1. Retainage withheld from payments owed to the Contractor during construction shall be in accordance with the construction contract provisions.
   2. Where TDHCA interim financing is provided, and construction retainage is in the amount of 10%, said retainage may be reduced to 5% (with prior approval) once construction for the entire project reaches 90% completion. This reduction in retainage cannot occur as a result of completion of construction phases, individual building completion, or completion of individual floors of buildings. This reduction in retainage requires prior consent of TDHCA, and such consent can only be given if there are no major outstanding issues or no pending Change Orders.

1.04 CHANGE ORDERS:

A. General:
   1. Change Orders to the construction contract shall be addressed as construction progresses, rather than being saved until the end of the project.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 00 00

GENERAL REQUIREMENTS

PART 1 - GENERAL REQUIREMENTS - CONTRACT

1.01 SCOPE OF WORK

A. The work included under these Contract Documents consists of furnishing all items, materials, operations, or methods listed, indicated, or scheduled on the Drawings and/or in these Specifications, including all labor, materials, equipment, transportation, temporary facilities, services, and incidentals, necessary and required for the construction and completion of the project named on the title in accordance with the Contract Documents.

1.02 CONTRACT DOCUMENTS

A. Contract Specifications: The General Requirements shall apply to every division of these specifications. All specification instructions are directed to the Contractor and the inclusion of any work by mention, note, or itemizations, however brief, implies the Contractor shall provide same, unless specifically directed otherwise. Where a specific Contractor is named, said contractor shall be responsible for and provide work so designated. In specifying an item by manufacturer's name and/or catalog number, such items shall be provided complete with all the standard devices and accessories as indicated in the latest edition of the manufacturer's catalog or brochure published at date of invitation to submit proposals, unless specifically stated otherwise.

B. Contract Drawings: The Contract Drawings, or Plans, on which the Proposal and Contract are based, are listed on the cover sheet of the Plans.
   1. In accordance with AIA Document A201 "General Conditions Of The Contract For Construction", shop drawing submittals provided for review, form no part of the Contract Documents, being for the use of the Contractor, subcontractors, and/or suppliers and manufacturers only.

1.03 GENERAL CONDITIONS

A. AIA Document A201 "General Conditions Of The Contract For Construction", 2017 edition, hereafter referred to as the "AIA General Conditions", is hereby made a part of the Specifications. Contractor shall consult this document and become thoroughly familiar with its contents before submitting his proposal.
   1. Amendments to the AIA General Conditions: The AIA General Conditions are hereby supplemented and amended. Where any article is amended, deleted, or superseded hereby, unaltered provisions of such article shall remain in effect.
   2. Article 1 - Contract Documents: Supplement Article 1.1, Definitions, as follows:
      a. When a word, such as "approved", "proper", "satisfactory", "equal" and "as directed" is used, it implies such reference is to the Architect's specified review and directions.
      b. "Provide" means furnish and install.
   3. Article 3 - Contractor: Supplement Subparagraph 3.5.1, as follows:
      a. Contractor warrants to Owner and Architect that on receipt of notice from either of them, within the period of one (1) year following date of Substantial Completion, that for defects in materials and/or workmanship which have appeared in the work, the Contractor will promptly correct such defects to the state of condition originally required by the Contract Documents at Contractor's expense.
   4. Article 6 - Separate Contracts: Supplement Paragraph 6.2 Mutual Responsibility of Contractors, as follows:
      a. Contractor shall assume general coordination and direction of the Project. Each subcontractor shall cooperate with other subcontractors on the work and install his work in sequence to facilitate and not delay the installation of such other subcontractors. The Architect is not the coordinator, nor the expediter of the work of the various contracts.

1.04 SPECIAL PROVISIONS

A. Insurance:
   1. Contractor shall purchase and maintain insurances required by AIA General Conditions, Paragraph 11.1 in the following minimum amounts:

a. Comprehensive General Liability $1,000,000.00 each person and $1,000,000.00 each occurrence.
b. Property Damage, $1,000,000.00 each occurrence, $1,000,000.00 aggregate.
c. Comprehensive Automobile Liability, $1,000,000.00 each person, $1,000,000.00 each occurrence, including Property Damage of $1,000,000.00 each occurrence.

2. Contractor shall require subcontractors to provide and maintain same insurance with same minimum limits.
3. Property Insurance (Builder's Risk) required under AIA General Conditions, Subparagraph 11.4.1, shall be purchased and maintained by the Contractor for the full insurable value of the entire work.

B. Wage Rate: Based on information received, prevailing wages do not apply to this job and, therefore, are not included.

C. Housing and Urban Development (HUD) Section 3 Requirements:
1. Based on information received, Section 3 Requirements do not apply to this job and, therefore, are not included.

D. Locations, Lines, and Levels:
1. The Owner shall furnish evidence of the locations of property lines, restrictions and a permanent benchmark. Contractor shall establish location of building on property and establish and maintain all other grades, line, levels and bench marks; check and compare all drawings, verifying grades, lines, levels and dimensions indicated thereon, and report all inconsistencies to the Architect and receive his instructions before commencing work.
2. The Contractor shall provide and maintain well-built batter boards at corners and establish and safeguard bench marks in at least two widely separated places and, as work progresses, establish bench marks at each building level and establish exact locations on partitions on rough floors as a guide to trades.

E. Building Permit:
1. The Contractor shall be responsible for obtaining and payment for a Building Permit.
2. The Contractor and/or his subcontractors shall be responsible for obtaining and paying for individual Plumbing, Electrical, Mechanical, and any other such permits and/or licenses as required by the local authorities.

F. Contractor shall be responsible for verifying measurements at the building before ordering material or doing work. No extra compensation will be allowed for difference between actual dimensions and measurements indicated on the drawings. Any differences found shall be submitted to the Architect and Owner for consideration before proceeding with the work.

G. The Geotechnical Report, which follows, is included for reference by the Contractor and other interested parties. Neither the Owner, nor the Architect, will assume any responsibility or liability for any information contained therein, or for assumptions made from said information.

H. Based on information received, (Phase 1) Requirements do not apply to this project, and therefore are not included.

I. Special Inspections: The Contractor, his subcontractors, and material suppliers shall comply with construction and fabrication provisions and allow all required inspections in accordance with the "Special Inspections" section of the prevailing Building Code(s).

J. Regulated Substances and Materials: No portion of the Construction Documents call for or require the use of the following regulated substances and Contractor shall not use products containing these regulated substances.:
1. Asbestos in any form.
2. Urea-formaldahyde foam insulation.
3. Any other chemical, material or substance the proposed or actual use of which is prohibited by local, State, or Federal regulation or law.

1.05 SPECIAL CONSTRUCTION REQUIREMENTS

A. The Contractor shall, by site visit prior to bid, determine the extent and nature of work involved in this project based on a visual inspection.

B. All reasonable attempts have been made to cover the scope of work involved. Should the Contractor discover during the course of construction, repairs, etc., that other conditions exist

which might require extra work, he shall immediately call this to the attention of the Architect. Once the Architect, Owner, and Contractor are in agreement on the extent and nature of said extra work, the General Contractor shall within fourteen (14) calendar days provide an estimated cost for extra work. Once extra cost has been reviewed and accepted by Owner and Architect a Change Order shall be processed and signed by all parties. Extra cost work done by the Contractor without following the aforementioned procedure or without providing the Owner with anticipated costs prior, will result in no payment for said work.

C. The Contractor shall at all times during the course of construction, and/or repair work protect all existing furnishings, finishes, construction, etc., which are to remain or have been delivered on site. Contractor shall be liable for losses for damage to items of that nature and shall repair to previous original condition or replace as situation dictates.

D. All fees for disposal are to be paid for by the Contractor. The site shall remain clean at all times from construction and demolition debris.

E. The Contractor shall fill and level with topsoil all areas of site rutted or cut up during the course of the Contract, then sod or seed as per the Contract Documents.

F. Existing sidewalks, street curbs, inlets, or other site improvements damaged during the course of the contract, but which previously were scheduled to remain, shall be replaced as necessary.

PART 2 - GENERAL REQUIREMENTS OF WORK

2.01 DRAWINGS

A. Do not scale Mechanical and Electrical Drawings for dimensions. Accurately lay-out such work from dimensions indicated on Contract Drawings. Consult Architect for interpretations concerning discrepancies or locations of equipment.

B. Consult all Drawings for miscellaneous items of each trade and provide same as indicated for a complete installation in accordance with manufacturer's product specifications.

2.02 SUBMITTALS

A. Submittals shall illustrate principal component parts, methods of assembly, mechanical and electrical connections, accessories and relationship to the building components. They shall consist of Product data, material data sheets, samples, and/or shop drawings required for the Architect's review that the correct products, assemblies, and quantities will be installed.

B. All Submittals shall be reviewed and approved – by stamp and/or signature - by the Contractor prior to submission to the Architect. Submittals received by the Architect and not first approved by the Contractor will be returned without review or processing.

C. Items generally requiring Submittals include, but are not limited to:
1. Concrete Floor Fill.
2. Cast Underlayment.
3. Masonry units, mortar materials, and accessories.
4. Manufactured stone masonry, and accessories.
5. Fabricated metal items, hangers, ledges, and shapes.
6. Finish Carpentry; trim profiles.
7. Ornamental Simulated Woodwork.
8. Dampproofing and Waterproofing.
9. Thermal Protection.
10. Weather Barriers
11. Roofing Materials and accessories.
12. Siding and Soffit Materials.
13. Firestopping.
14. Joint Protection.
15. Wood Doors.
16. Windows.
17. Finish Hardware.
18. Gypsum Board.
19. Ceramic Tile and Accessories.
20. Resilient Flooring and accessories.

21. Carpeting and accessories.
22. Paints, Stains, and Coatings.
23. Signage.
24. Toilet and Bathroom Accessories.
25. Fire Protection Specialties.
26. Postal Specialties.
27. Closet and Storage Shelving.
28. Residential Appliances.
29. Playground Equipment
30. Window Treatments.
31. Residential Cabinets and Countertops.
32. Elevators.
33. Termite Control.
34. Site Furnishings.

2.03 SELECTION AND REVIEW OF MATERIALS

A. Where materials or equipment require the review of the Architect, secure such review before procurement.

B. Where colors and/or patterns are to be selected by Architect and/or the Owner, request such selection in ample time for procurement.

C. The aesthetic values of every material and installation, such as shape, proportion, texture, finish and color, will be an important consideration to the Owner and/or Architect, and decisions concerning same shall be final.

2.04 CONTRACTOR'S MEANS AND METHODS

A. The Architect shall not be responsible for, nor have control over, nor charge of construction means, procedures, methods, techniques, or for safety programs or precautions in conjunction with the project construction. The Contractor shall be solely responsible for these under the Construction Contract.

B. The Architect shall not be responsible for the Contractor's failure to carry out work in accordance with the Contract Documents. The Architect shall not have control over, nor in any way be responsible for, the Contractor's scheduling, or acts, or omissions of the Contractor, subcontractors, or their agents or employees, or of any other persons performing portions of the work.

C. The Contractor shall initiate, maintain, and supervise all safety precautions and programs in conjunction with the performance of the Contract, and shall be responsible for same.

D. The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders of public authorities dealing with safety of persons or property or their protection from damage, injury, or loss. The Contractor shall also give notices in accordance with the foregoing.

E. The Contractor shall construct and maintain temporary drainage and pump as necessary to keep site and excavations free from water, remove ice and snow as necessary for safety and proper execution of his work, provide cover and protection for his work from inclement weather and brace all construction to prevent damage from wind.

F. Keep covered all materials, cavities and holes subject to damage by falling materials or deposits of water, snow or ice.

G. Hot and Cold Weather protocols, where applicable or dictated by manufacturer's instructions, shall be adhered to.

H. Transport, handle, store, and erect materials in a manner to keep them free from damage.

I. Support no runways, ramps, or construction equipment on, or transport over, any surface or assembly subject to displacement, disfigurement, or other damage.

J. Protect work in place that requires job-finishing, until such finishing has been completed.

K. Protect work previously placed by suitable coverings during installation of subsequent work. Clean off any foreign materials accidentally deposited on finish surfaces and, where such

would stain, corrode or otherwise disfigure, clean immediately with material that will not damage finished work.

L. Where finished floors in place are subject to ongoing construction damage, cover traffic areas with suitable protective coverings until project acceptance.

2.05 TEMPORARY EQUIPMENT

A. Contractor shall provide temporary hoists, ladders, scaffolding, shoring, bracing, runways, walks, ramps, and other equipment or construction, required for proper progress of his work and remove same at completion of work.

2.06 APPROPRIATE MATERIALS AND INSTALLATION

A. Prior to submitting proposal, Contractor, his subcontractors, and material suppliers shall review the Contract Documents and, should any material and/or its installation be indicated or specified in a manner not approved by the material manufacturer, notify the Architect and receive his instructions. Failing to do so, Contractor shall provide other equivalent materials suitable for the installation as selected by the Architect, or if not discovered until after installation, Contractor shall replace materials with such other equivalent, suitable and selected materials, and in either event, at no added cost to Owner.

B. All materials shall be new unless otherwise specifically covered by the Contract Documents or approved by the Owner.

C. Materials or products specified by name of manufacturer, brand or trade name, and/or catalog reference in the Contract Documents, shall be deemed to establish standards of quality and style, and not to be proprietary in nature. Any article or material, which will adequately perform the duties imposed by the general design, will be considered equal, providing it is of equal substance and function.

D. If Contractor proposes construction methods other than those shown or specified, complete drawings and engineering notes shall accompany the request. Contractor shall follow the Submittal process as outlined, for review by the Architect, Architect's consultants, and/or Owner's consultants.

2.07 RECEIPT AND STORAGE OF MATERIALS

A. On receipt of materials check for in-transit damage promptly, should it be necessary to replace any damaged materials prior to installation.

B. Deliver materials and equipment to project site in manufacturer’s original packaging. Keep labels intact until final cleaning. Where items are to be job-assembled, label, tag, mark or otherwise properly identify each assembled component part until incorporated in the work.

C. Store materials in a manner to prevent deterioration, staining, soiling and intrusion of foreign materials. Provide waterproof, well-ventilated enclosures for materials subject to deterioration by dampness. Adequately protect those materials subject to damage by freezing and frost.

2.08 CLOSING-IN WORK

A. Contractor shall notify his subcontractors, Owner and all contractors and subcontractors under separate contract to the Owner, when he is ready for them to install their portions of the work and see that they comply within a reasonable period of time. Do not enclose nor cover any piping, wiring, ducts, equipment, or other items until proper tests and inspections have been made by Authorities having Jurisdiction, or observed by the Architect.

2.09 WARRANTIES

A. Prior to being eligible for final payment, Contractor shall deliver to Architect, all Manufacturer’s and special warranties specified in the Contract Documents for materials, equipment, and installations. These shall be compiled in a book and must include the name, address and phone number of the installation subcontractor, the name, address and phone number of the supplier and the printed warranty on at each model of each of the following items:

1. Water Heaters.
2. Heating and Air Conditioning systems.
3. Appliances; including, but not limited to: range, range hood, refrigerator, microwave, and washers and dryers.
4. Siding and Soffit materials.

5. Gutters and Downspouts.
6. Roofing system.

B. The Contractor shall provide a one (1) year warranty (Guarantee) from the date of Final Completion and acceptance by the Owner, during which time he shall make needed repairs and replacements of defective workmanship or materials, or correction of non-conforming work as outlined in paragraph 12.2.2 of the Contract General Conditions.

2.10 TEMPORARY FACILITIES

A. Field Office: Contractor shall erect and maintain in good condition during progress of work a weatherproof field office building (adequate size trailer also acceptable) for use of General Contractor and Architect's Representative. Provide such building with heat, electric light, telephone and lockable door.

B. Toilet Facilities: Contractor shall provide temporary, exterior, completely closed latrine. Provide necessary supplies and keep clean at all times.

C. Electrical Service: Contractor shall arrange and pay for temporary metering electrical service to his Field Office and Project Site sufficient for his needs throughout the construction process. Use of electrical service in buildings is not permitted, unless previously agreed to by the Owner. Provide lights and electrical extensions to locations necessary for proper and safe operations and permit other contractors to use and remove the same at his own expense. The General Contractor shall pay for all temporary electrical service consumed from start of project though Final Closeout.

D. Water: Contractor may use water from existing hose bibbs or extend lines therefrom at their own expense. Contractor shall pay for and provide a temporary water meter at the connection and shall pay for all water consumed. Contractor is fully responsible for monitoring all water consumption to prevent "wasteful" use and to prevent connection/use from other connection locations.

E. Heat: Contractor shall provide auxiliary heat necessary to prevent damage from dampness and cold and to provide proper climate conditions as necessary to prohibit damage to installed materials. Contractor shall pay for all fuels (i.e., propane, LP, Natural gas, etc.) and/or electrical service consumed for heating until building is completed.

F. Telephone: Contractor shall provide temporary telephone for use by all trades and by Architect. Contractor shall pay for all local calls, but shall be reimbursed for long-distance calls by those making same.

PART 3 - PROJECT CLOSE OUT

3.01 GENERAL

A. Owner may place and install equipment during the progress of the building or occupy portions finished before the entire completion of the work. Such occupancy will not in any way evidence completion or acceptance of any part of the work.

B. Record Drawings: Maintain a complete set of blue/black-line prints of Contract Drawings, Specifications, and shop drawings for record mark-up purposes throughout the Contract Time. Mark-up drawings and specifications during course of the work to show changes and actual installation conditions, sufficient to form a complete record for Owner's purposes. Give particular attention to work which will be concealed and difficult to measure and record at a later date, and work which may require servicing or replacement during life of project. Require entities marking prints to sign and date each mark-up. Bind prints into manageable sets, with durable paper covers, appropriately labeled.

C. Maintenance Manuals: Provide 3-ring vinyl-covered binders containing required maintenance manuals, properly identified and indexed. Include operating and maintenance instructions, expanded to cover emergencies, spare parts, warranties, inspection procedures, diagrams, safety, security, and similar appropriate data for each system or equipment item.

3.02 ENERGY AUDIT TESTING

A. When required, perform duct leakage and blower door testing in conformance with the International Energy Conservation Code (IECC- current edition) Energy Efficiency requirements.

1. Tests shall be performed on All Dwelling Units, unless noted otherwise.
2. Submit required Energy Audit Report to Architect for review.
3. Post compliance certificate in each Dwelling Unit, as required.

3.03 INSPECTION - PREREQUISITES

A. Comply with the General Conditions and complete the following before requesting Architect's inspection of the work, or designated portion thereof, for substantial completion.

B. Submit executed warranties, workmanship bonds, maintenance agreements, inspection certificates, and similar required documentation for specific units of work, enabling Owner's un-restricted occupancy and use.

C. Submit record documentation, maintenance manuals, tools, spare parts, keys, and similar operational items.

D. Operator Instructions: Require each Installer of systems requiring continued operation/ maintenance by Owner's maintenance personnel, to provide on-location instruction to Owner's personnel, sufficient to ensure safe, secure, efficient, non-failing utilization and operation of systems.

E. Final Cleaning: At closeout time, clean or re-clean entire work to normal level for "first class" maintenance/cleaning of building projects of a similar nature. Remove non-permanent protection and labels, polish glass, clean exposed finishes, touch-up minor finish damage, clean or replace filters of mechanical systems, remove debris and broom-clean non-occupied spaces, sanitize plumbing/food service facilities, clean light fixtures and replace burned-out/dimmed lamps, sweep and wash paved areas, police yards and grounds, and perform similar cleanup operations needed to produce a "clean" condition as judged by Architect.

3.04 INSPECTION PROCEDURES

A. Upon receipt of Contractor's request, Architect will either proceed with inspection or advise Contractor of prerequisites not fulfilled.

B. Following initial inspection, Architect will either prepare a Certificate of Substantial Completion, or advise Contractor of work which must be performed prior to issuance of said certificate; and repeat inspection when requested and assured that work has been substantially completed. Results of completed initial inspection will form initial "punch-list" for final acceptance.

C. Re-inspection Procedure: Upon receipt of Contractor's notice that work has been completed, including punch-list items resulting from earlier inspections, and excepting incomplete items delayed because of acceptable circumstances, Architect will re-inspect work. Upon completion of re-inspection, Architect will either recommend final acceptance and final payment, or advise Contractor of work not completed or obligations not fulfilled as required for final acceptance. If necessary, procedure will be repeated.

END OF SECTION

SECTION 01 00 10

GEOTECHNICAL REPORT

DOCUMENTS

1.01 APPLICABLE TO THIS CONTRACT, AND ATTACHED FOLLOWING THIS PAGE IS:

GEOTECHNICAL REPORT
ECS Southwest, LLC
59 Pages Total
10/ 19/ 2024

ECS Southwest, LLP

Geotechnical Engineering Report

Dashwood Trails Apartments

Dashwood Drive and Jetty Lane
Houston, Harris County, Texas

ECS Project Number 43:3223

October 17, 2024

October 17, 2024

Mr. Corey Orman
Carlson Consulting Engineers, Inc.
7068 Ledgestone Commons
Bartlett, Tennessee 38133

ECS Project No. 43:3223

Reference: Geotechnical Engineering Report
Dashwood Trails Apartments
Dashwood Drive and Jetty Lane
Houston, Harris County, Texas

Dear Mr. Orman:

ECS Southwest, LLP (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to Carlson Consulting Engineers, Inc. during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide construction phase observation and materials testing work. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Southwest, LLP

Vincent Yin, G.I.T.
Geotechnical Staff Project Manager
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Richard E. Webb, P.E.
Geotechnical Principal Engineer
REWebb@ecslimited.com

The *electronic seal in this document was authorized by Richard E. Webb, P.E. No 60460, on October 17, 2024.*

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- Boring Logs

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- Laboratory Testing Summary
- Unconsolidated-Undrained (UU) Compressive Strength

EXECUTIVE SUMMARY

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal foundation recommendations are summarized. This Executive Summary is intended as a very brief overview of the principal geotechnical conditions that are expected to affect design and construction. Information gleaned from the executive summary should not be utilized in lieu of reading the entire geotechnical report.

- The subsurface soil conditions observed at the site generally consisted of approximately 2 feet of surficial Lean Clay Fill (CL FILL) and Fat Clay Fill (CH FILL) underlain by Fat Clay (CH) and Lean Clay (CL) extending up to the maximum explored depth of about 20 feet below the existing site grade.

- Groundwater was not observed in the borings during drilling and/or shortly after completion of drilling.

- The onsite soils are considered to have high expansion potential with Potential Vertical Movement (PVM) to be approximately 3½ inches for "dry" conditions for the proposed grade-supported structures. Therefore, we anticipate that subgrade improvements will be required to reduce the PVM. Subgrade improvement recommendations options are presented to reduce the PVM to about 1 inch.

- The planned building structures can be supported on a shallow spread footing foundation with a slab-on-grade floor slab or a monolithic slab-on-grade foundation. Detailed design and construction recommendations are outlined within this report.

- A below-grade detention vault is planned to be constructed in the northwestern portion of the project site. We assumed that the depth of the detention vault will be approximately 8 feet below the existing site grade.

- Rigid Concrete and/or Flexible Asphalt pavements can be used in conjunction with lime-treated clay and/or reworked onsite clay soils for light truck traffic for main drives and medium duty (drives) pavements to accommodate occasional heavier loadings due to fire trucks, delivery vehicles.

- It is recommended that ECS conduct a geotechnical review of the project plans (prior to issuance for construction) to check to see that ECS' geotechnical recommendations have been properly interpreted and implemented.

- To prevent misinterpretation of ECS recommendations, we recommend ECS be retained to perform quality control testing and documentation during construction of the earthwork and foundations for the project.

1.0 INTRODUCTION

The purpose of this study was to provide geotechnical design and construction recommendations for an approximate 25,000-square foot, four-story residential apartment complex that will have 98 units, a below-grade detention vault, and 156 parking spaces for passenger vehicles. The recommendations developed for this report are based on project information supplied via an email on February 15, 2024.

Our services were provided in accordance with our Proposal No. 43:5364-GP, dated August 16, 2024. Mr. Dean L. Carlson, P.E. with Carlson Consulting Engineers, Inc. authorized our services by signing the "Professional Services Agreement Amendment #1" on August 29, 2024.

This report contains the procedures and results of our subsurface exploration and laboratory testing programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items.

- A brief review and description of our field and laboratory test procedures and the results of testing conducted.
- A review of surface topographical features and site conditions.
- A review of area and site geologic conditions.
- A review of subsurface soil stratigraphy with pertinent available physical properties.
- A final copy of our soil test borings.
- Estimation for Potential Vertical Movement (PVM) in accordance with Tex-124-E.
- Recommended foundation types with pertinent design recommendations.
- Design and construction recommendations of detention vault.
- Recommendations for preparation of pavement subgrades and suggested pavement sections.
- Recommendations for site preparation and construction of compacted fills, including an evaluation of on-site soils for use as compacted fills.
- Evaluation and recommendations relative to groundwater control.
- An evaluation of soil excavation issues.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE

The project site is located near Dashwood Drive and Jetty Lane in Houston, Harris County, Texas. The location of the project site is presented below and on the Site Location Diagram in Appendix A.

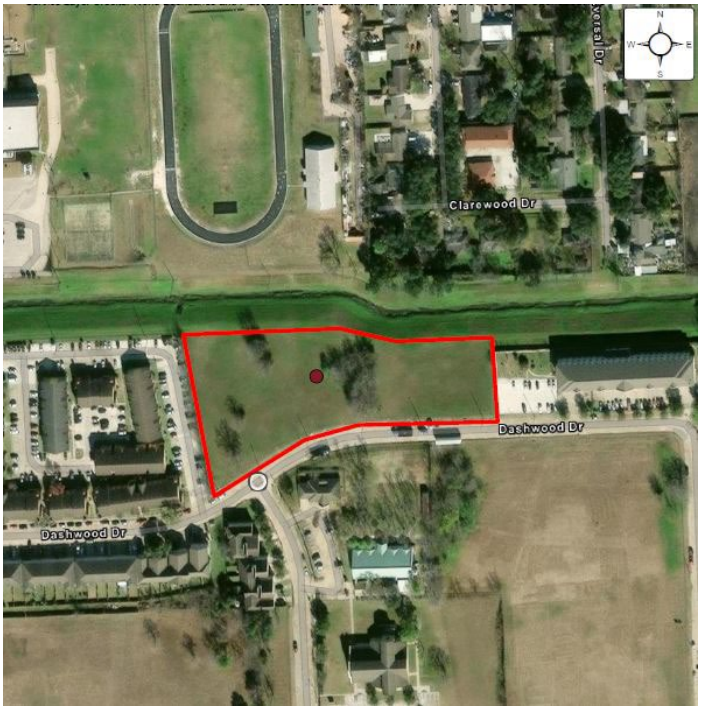


Figure 1: Site Location

The project site is generally flat with surface elevations between approximately 74.5 feet to 76 feet above MSL. The elevations and topographic variations were obtained from available Google Earth and may not be accurate enough for engineering purposes. While preparing this report, we reviewed available documents consisting of USGS topographic maps and USDA soil maps. The subject site is currently undeveloped and covered with light vegetative growth and scattered trees. We did not observe other noteworthy features within the project site during our review. A Topographic Map is presented in Appendix A.

We reviewed Historical Aerial Photographs (presented in Appendix A) to identify the past usage and location of the previously existing development within the project site. Our aerial photo review summary table is presented below:

Table 1: Historical Aerial Photography Summary Table

YEAR	SUBJECT PROPERTY USAGE	ADJACENT PROPERTY USAGE
1978	Generally undeveloped and covered with light vegetative growth.	Residential development to the north of the project site. The remaining site vicinity is generally undeveloped.
1989	No noteworthy improvements.	Residential development to the west of the project site. Track and field constructed north of the project site.
2005	No noteworthy improvements.	Commercial development to the south of the project site.
2009	No noteworthy improvements.	3-Story apartment building constructed east of the project site.
2024	No noteworthy improvements.	Gradual residential development to the southwest and commercial development to the east of the project site.

2.2 PROPOSED CONSTRUCTION

The following information explains our understanding of the planned development including the proposed buildings:

Table 2: General Project Information

SUBJECT	DESIGN INFORMATION / ASSUMPTIONS
Usage	Multifamily residential
Number of Stories	Four-story
Column Loads	50 kips Maximum (Assumed)
Wall Loads	3 kips/ft Maximum (Assumed)
Building Finish Floor Elevation	76.5 feet above MSL
Detention Vault	One, about 8 feet deep (Assumed)
Site work	General earthwork, detention vault, and pavement
Pavement	Rigid concrete and/or flexible asphalt

3.0 FIELD EXPLORATION

Our exploration procedures are explained in greater detail in Appendix B including the insert titled Subsurface Exploration Procedure. Our scope of work included drilling ten borings. Our borings were located with a handheld GPS unit and their approximate locations are shown on the Boring Location Diagram in Appendix A.

3.1 SUBSURFACE CHARACTERIZATION

Based on the Houston Sheet, Texas, Geologic Atlas of Texas (Bureau of Economic Geology, University of Texas, 1982), the site is located within the Beaumont Formation (Qb), which consists predominantly of clay and mud soils with silt. These soils can contain beds and lenses of fine sand and decayed organic matter and many buried organic-rich soil zones that contain calcareous and ferruginous nodules. This material includes plastic and potentially compressible clay that was deposited in flood basins, coastal lakes, and former stream channels on a deltaic plain. The thickness of this formation is approximately 5 to 10 feet along the north edge of the outcrop and thickens southward in the subsurface to more than 100 feet. A Regional Geology Map is presented in Appendix A.

The subsurface soil conditions observed at the site generally consisted of approximately 2 feet of surficial Lean Clay Fill (CL FILL) and Fat Clay Fill (CH FILL) underlain by Fat Clay (CH) and Lean Clay (CL) extending up to the maximum explored depth of about 20 feet below the existing site grade. Please refer to the boring logs in Appendix B. A Generalized Subsurface Profile is presented in Appendix A. Table 3 below summarizes the subsurface stratigraphy encountered at the project site.

Table 3: Subsurface stratigraphy

Approximate Depth to Bottom of Strata (feet)	Elevation of Bottom of Strata (feet)[1]	Stratum	description	Consistency / Density
0 to 2	EL. +72.5 to 76.0	I	(CL/CH FILL) LEAN CLAY/FAT CLAY FILL, dark gray, dark brown, with trace gravels, root fibers, and sand seams	Hard
2 to (6-20)	EL. +54.5 to 74.0	II	(CH) FAT CLAY, dark gray, dark brown, and reddish brown, with ferrous and calcareous nodules	Very Stiff to Hard
(12-17) to 20[2]	EL. +55.0 to 63.0	III	(CL) LEAN CLAY, dark gray, reddish brown, with ferrous nodules and sand seams	Hard

1. Ground surface elevations were not surveyed by a licensed surveyor. Elevations were obtained using Google EarthTM and are approximate.
2. Only encountered in Borings B-01 and B-06.

3.2 GROUNDWATER OBSERVATIONS

Groundwater level observations were made in the borings during and at completion of drilling operations. In auger drilling operations, water is not introduced into the borehole and the groundwater position can often be determined by observing water flowing into the excavation. Furthermore, visual observation of soil samples retrieved can often be used in evaluating the groundwater conditions. Groundwater was not observed during drilling of the borings. Shortly after completion of drilling the borings, the borings also remained dry.

Variations in groundwater can occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors. The highest groundwater observations are normally observed in the late winter and early spring. Therefore, the groundwater conditions at this site could be different at the time of construction. The possibility of groundwater level fluctuation should be considered when developing the design and construction plans for the project. Installation and monitoring of observation wells over a longer period of time would be required to assess true groundwater elevation.

3.3 LABORATORY TESTING

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples. The tests included moisture content (ASTM D2216), Atterberg limits (ASTM D4318), Passing No. 200 Sieve (ASTM D1140), and unconsolidated-undrained (UU) compressive strength (ASTM D2850).

The samples were visually classified on the basis of texture and plasticity in general accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and ASTM D2487 Standard Practice for Classification for Engineering Purposes (Unified Soil Classification System (USCS). After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; in situ, the transitions may be gradual.

4.0 DESIGN RECOMMENDATIONS

The following sections present more detailed recommendations regarding the proposed multifamily residential development. These include recommendations regarding building foundations, detention vault, drainage, earthwork, ground slabs, and pavement. The following recommendations have been developed based on the previously described project characteristics and subsurface conditions. If there are any changes to the project characteristics or if different subsurface conditions are encountered during construction, ECS should be consulted so that the recommendations of this report can be reviewed.

Based on the provided grading plan, we understand that the final site grade of the complex will be at 76.5 feet above MSL, about ½ to 2 feet above existing grade. Discussion of the factors affecting the building foundations for the proposed structures, as well as additional recommendations regarding design and construction at the project site are included below.

4.1 EXISTING FILL SOILS

Fill soils were observed to a depth of 2 feet below the existing grade within the project site. The depths of the fill soils may vary across the site and should be evaluated at the time of construction. Unless placed properly, compacted, and documented, fill can vary in composition, relative density, and consistency. Supporting foundations and floor slabs on undocumented fill can result in excessive foundation and floor slab movement and is not recommended. The fill soils in the proposed building area should be removed. Existing fill materials meeting select fill requirements can be reworked and reused in accordance with the recommendations presented within this report.

4.2 POTENTIAL VERTICAL MOVEMENTS

Based upon the laboratory test results performed on selected soil samples, the subsoils encountered at this site are considered to have high expansive potential. These soils generally have a greater potential to experience volumetric changes with fluctuations in moisture content also known as “Potential Vertical Movement (PVM)”. These soils can subject structures to movements (due to shrinking and swelling) with fluctuations in their moisture content, throughout the life of the structure and after construction is complete.

We have estimated potential heave for this site utilizing the TxDOT method (Tex-124-E). The Tex-124-E method provides an estimate of potential vertical movement (PVM) using the liquid limits, plasticity indices, and existing water contents for soils. The PVM is estimated in the seasonally active zone, which can be up to about 8 feet in the site vicinity.

Based on test method Tex-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, and our experience with similar soils, we estimate potential vertical movements (PVM) to be approximately 3½ inches for “dry” conditions. The actual movements could be greater if poor drainage, ponded water, and/or other unusual sources of moisture are allowed to wet the soils beneath the structure after construction.

In this general area, most structural and geotechnical engineers consider a PVM of about 1 inch or less to be within acceptable tolerances for properly designed at-grade supported structures. However, this movement does not take into consideration the movement criteria required or perceived by the owner

or occupants. These "operational" performance criteria may be, and often are, more restrictive than the structural criteria or tolerances.

4.2.1 Subgrade Improvements

To reduce the PVM to approximately 1 inch and reduce the risk associated with future movements, we are recommending the building pad subgrade improvement options noted in the following table:

Table 4: Subgrade Improvements

	DEPTH OF LOW-EXPANSIVE FILL[(1)] (FEET)	DEPTH OF MOISTURE CONDITIONING[(2)] (FEET)	TOTAL DEPTH OF IMPROVED ZONE (FEET)	PVM (INCH)
Option I	5	0	5	≈ 1
Option II	1	6	7	≈ 1
Note.	1. Low-expansive fill soils typically consist of "Select Fill" materials with properties outlined in the "Material Specifications" section of the report. The on-site clay soils may be treated with lime (outlined as "Lime-Treated On-Site Clay") and placed in lieu of Select Fill in accordance with the "Material Specifications" section of the report. 2. Depth of moisture conditioning will include removing, reworking, and recompacting on-site clays with proper engineering efforts outlined as "Moisture-Conditioned On-Site Clay Fill" in the "Material Specifications" section of the report.			

Specific recommendations for material requirements and installation procedures may be found in the 'Site Construction Recommendations' section of this report. The improved soil zone should extend at least 5 feet beyond the structure footprint and include flatwork sensitive to movements such as sidewalks or pavements.

Some of the risks associated with placing slabs or foundations on improved subgrades may include uneven floors, floor and wall cracking and sticking doors or windows. The higher the designed PVM, the higher the risk is for future performance issues. ECS should be contacted if a PVM other than 1 inch is required.

4.3 FOUNDATION RECOMMENDATIONS

Based on our subsurface exploration and laboratory testing, we are providing the following recommendations to support the proposed building structures on a shallow spread footing foundation with a slab-on-grade floor slab or a monolithic slab-on-grade foundation. The following section presents our detailed design and construction recommendations. The design team members (Owner/Developer/Architect and/or the Structural Engineer of Record) should discuss these options and select the appropriate foundation systems for the proposed structures.

4.3.1 Shallow Spread Footings

Upon mitigating the existing fill soils and reducing the PVM to 1 inch, the proposed building structures can be supported by shallow spread and/or continuous footings. We recommend the foundation design use the following parameters shown in Table 5 below:

Table 5: Shallow Foundation Design Parameters

DESIGN PARAMETER	COLUMN FOOTING	WALL FOOTING
Net Allowable Bearing Pressure(1)	3,000 psf	3,000 psf
Acceptable Bearing Soil Material	Stiff clay or compacted Select Fill	Stiff clay or compacted Select Fill
Minimum Width	24 inches	18 inches
Minimum Footing Embedment Depth (below finished grade)	2 Feet	2 Feet
Estimated Total Settlement (2)	Approx. 1 inch	Approx. 1 inch
Estimated Differential Settlement (3)	About ½ inch between columns	About ½ inch over a distance of 30 feet

Notes:

(1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.

(2) Based on our assumed structural loads. If final loads are different, ECS should be contacted to update foundation recommendations and estimated settlement values.

(3) Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

The final footing and/or grade beam elevation should be evaluated by competent geotechnical engineering personnel to verify that the bearing soils are capable of supporting the recommended net allowable bearing pressure and are appropriate for foundation construction. These evaluations should include visual observations and may use the Dynamic Cone Penetration (DCP) testing (ASTM STP-399) or similar alternatives. If DCP testing is performed, the tests should be performed within each column footing excavation (minimum of 2 tests per column footing) and at intervals not greater than 25 feet in continuous footings. The DCP testing should extend at least 4 feet below the final foundation subgrade. A minimum DCP value of 12 blows/6" (Kessler 17.6-lb dual-mass hammer DCP) may be used for the evaluation of the foundations.

4.3.1.1 Potential Undercuts

The soils at the foundation bearing elevation are anticipated to be appropriate for support of the proposed structure. However, if soft or undesirable soils are observed at the footing bearing elevations, the soils should be undercut and removed. The undercut should be backfilled with lean concrete (f'c ≥ 1,000 psi at 28 days) up to the original design bottom of footing elevation; the original footing should be constructed on top of the hardened lean concrete.

4.3.1.2 Uplift Considerations

The ultimate uplift capacities of the shallow foundation can be obtained from the weight of the foundation and weight of the backfill soils directly above the spread footing. A minimum factor of safety of 1.2 should be used to compute allowable uplift capacity.

4.3.1.3 Lateral Considerations

Lateral loads on shallow footings are resisted by (a) soil friction at the base and (b) by the passive resistance along the side of the foundations. To compute the frictional resistance at the base, a friction coefficient of 0.33 may be used between the foundation bottom or concrete slabs and the supporting

soils. A passive resistance of properly compacted fill of 225 psf per foot can be used along the foundation. The friction and passive resistance values are ultimate values and do not include factors of safety. The passive pressure and the frictional resistance of the soils can be combined in determining the total lateral resistance.

4.3.1.4 Slab-on-Grade

Upon mitigating the existing fill soils and reducing the PVM as recommended, the planned building structures can be supported on shallow foundations in conjunction with a slab-on-grade floor. A soil modulus of subgrade reaction (ks) of 100 pci can be used in the design of floor slab.

We recommend that floor slabs be isolated from the foundation footings so differential settlement of the structure may not induce shear stresses in the floor slab. To reduce the crack width of shrinkage cracks that may develop near the surface of the slab, we recommend reinforcement be included in the design of the floor slab. The reinforcement should be in the top half of the slab to be effective.

A bedding layer of sand, 4 inches in thickness, should be placed beneath the floor slab. If floor treatments that are sensitive to moisture are used, a 10-mil vapor retarder of polyethylene sheeting or similar material should be placed beneath the slab to reduce moisture migration through the slab. If a vapor retarder is considered to provide moisture protection, special attention should be given to the surface curing of the slabs to reduce uneven drying of the slabs and associated cracking and/or slab curling. The use of a blotter or cushion layer above the vapor retarder can also be considered for project specific reasons. Please refer to ACI 302.1R96 Guide for Concrete Floor and Slab Construction and ASTM E1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs for additional guidance on this issue.

4.3.2 Monolithic Slab-on-Grade

Upon mitigating the existing fill soils and reducing the PVM as recommended, the planned building structures can be supported by a monolithic slab-on-grade/grade beam structural foundation system. This system may be designed with conventional reinforcing or by post-tensioning. The slab should be designed in accordance with WRI/CRSI “Design Slab-On-Ground Foundations” or PTI “Design and Construction of Post-Tensioned Slabs-On-Ground”. The following design parameters are recommended for the Post-Tensioning Institute's slab-on-grade design method (3rd Edition):

Table 6: Post-Tensioned Slab Parameters - PTI 3rd Edition with 2008 Supplements

DESIGN PARAMETERS	OPTION I; PVM ≈ 1 (INCH)	OPTION II; PVM ≈ 1 (INCH)
e_m Edge (feet)	4.8	4.8
y_m Edge (inches)	0.5	0.8
e_m Center (feet)	8.7	8.3
y_m Center (inches)	0.7	1.0
Effective PI	32	40
Design Suction Profile	Post-Equilibrium	
Thornthwaite Moisture Index	18	
Slab Subgrade Coefficient (Slab-on-Vapor Sheeting over Sand)	0.75	

As an alternative, the following design parameters are recommended for the WRI/CRSI "Design Slab-On-Ground Foundations (August, 1981)":

Table 7: BRAB/WRI Slab Parameters

DESIGN PARAMETERS	OPTION I; PVM ≈ 1.0 (INCH)	OPTION II; PVM ≈ 1.0 (INCH)
Allowable Bearing Capacity	2,000 psf	2,000 psf
Design PI	32	40
Climatic Rating (Cw)	26	26
Unconfined Compressive Strength	2,500 psf	2,500 psf
Soil-Climate Support Index (1-C)	0.12	0.18

Grade beams should have a minimum width of 12 inches to reduce the possibility of foundation bearing failure and excessive settlement due to local shear or "punching" failures. Additionally, the grade beams should extend at least 18 inches and 24 inches below final adjacent grades for interior and exterior beams, respectively. Fills should be sloped to drain surface water away from the structures. We anticipate that foundations, grade beams and slabs designed using the recommended allowable bearing pressures will experience settlements on the order of an inch.

The recommended differential movement values are based on climate-controlled soil conditions and are not valid when influenced by significant other conditions, such as trees, poor drainage, slope, cut and fill sections, etc. These design parameters also assume that positive drainage will be provided away from the structures. Moderate irrigation of surrounding lawn and planter areas may be performed without allowing excessive wetting or drying of soils adjacent to the foundations. Greater potential movements may occur with extreme wetting or drying of the soils due to ponding of water, plumbing leaks or lack of irrigation. In the event that sprinkler systems are used, we recommend that the sprinkler system be placed all around the structure to provide a relatively uniform moisture condition throughout the year. This will try to reduce fluctuations in subsoil moisture and corresponding movement.

If floor treatments that are sensitive to moisture are used, a 10-mil vapor retarder of polyethylene sheeting or similar material should be placed beneath the slab to reduce moisture migration through the slab. If a vapor retarder is considered to provide moisture protection, special attention should be given to the surface curing of the slabs to reduce uneven drying of the slabs and associated cracking and/or slab curling. The use of a blotter or cushion layer above the vapor retarder can also be considered for project specific reasons. Please refer to ACI 302.1R96 *Guide for Concrete Floor and Slab Construction* and ASTM E1643 *Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs* for additional guidance on this issue.

Based on the provided grading plan, the final site grade of the complex will be at 76.5 feet above MSL, which is about ½ to 2 feet above existing grade. Fill placed on the site should be in accordance with our recommendations given in the "Site Construction Recommendation" section.

4.4 PERIMETER CONDITIONS

Soils placed along the exterior of grade beams/perimeter walls should be on-site clay soils or lime-treated clay placed and compacted in accordance with this report. The purpose of this backfill is to reduce the

opportunity for surface or subsurface water infiltration beneath the structure. The overbuild zone of select granular soils should be removed outside of the perimeter grade beams and backfilled with on-site clay or lime-treated soils. If lime-treated material is used as select, this overbuild removal is not required.

We recommend paving/sidewalks be placed adjacent to the structures to reduce seasonal drying of the near surface soils near the perimeter of the structures. Irrigation of lawn and landscaped areas should be moderate, without allowing excessive wetting or drying of soils around the perimeter of the structures. Sprinkler systems should be used around the perimeter of the structure to maintain a relatively uniform moisture distribution around the foundation slab.

Positive drainage away from the structures should be provided and strictly maintained during the life of the structures. Where flatwork is placed against or near the structure, a positive seal should be installed and adequately maintained to reduce water intrusion. Down spouts and gutters should be used to collect and distribute water at least 10 feet away from the structure.

Trees and taller bushes/shrubs planted near the perimeter of the structures can withdraw large amounts of water from the soils. We recommend trees not be planted or left in place (existing trees) closer than half the canopy diameter of mature trees from the grade beams, typically a minimum of 20 feet. If vegetation is planted closer than the anticipated mature height away from the buildings, then a root barrier should be installed to a depth of at least 5 feet below finished grade.

4.5 DETENTION VAULT DESIGN CONSIDERATIONS

4.5.1 Allowable Bearing Pressure

The proposed detention vault can be supported by shallow spread and/or continuous footings. We recommend the foundation design use the following parameters shown in Table 8 below:

Table 8: Shallow Foundation Design Parameters

DESIGN PARAMETER	COLUMN FOOTING	WALL FOOTING
Net Allowable Bearing Pressure(1)	3,000 psf	3,000 psf
Acceptable Bearing Soil Material	Stiff clay or compacted Select Fill	Stiff clay or compacted Select Fill
Minimum Width	24 inches	18 inches
Minimum Footing Embedment Depth (below finished grade)	2.0 Feet	2.0 Feet

Notes:

(1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.

4.5.2 Lateral Earth Pressure

Based on the conceptual site plan provided to us by the Client, a below-grade detention vault is planned to be constructed in the northwestern portion of the project site near Borings B-01 through B-03. We assumed that the depth of the detention vault will be approximately 8 feet below the existing site grade. Based on our subsurface exploration and laboratory test data near Borings B-01 through B-03, the generalized subsurface soils with corresponding depths are presented below:

Table 9: Generalized Subsurface Soils and Depths Observed within the Detention Vault

SOIL TYPE	DEPTH (FEET)	CONSISTENCY
Fat Clay Fill (CH FILL)	0 – 2	Hard
Fat Clay (CH)	2 – (17-20)	Very Stiff to Hard
Lean Clay (CL)	17 – 20	Hard

The detention vault will be subjected to lateral earth pressures from hydrostatic water pressure, soil pressure, and surcharge loads adjacent to the vault. Lateral earth pressures can be calculated by multiplying the equivalent fluid density of the surrounding soils and unit weight of water by the depth below the ground surface. ECS recommends the detention vault design assume the water table at the ground surface or a fully submerged condition due to hurricane storm surcharge. The following equivalent fluid densities and submerged unit weights of the soil located in Table 10 below can be used for design to resist lateral loading.

Table 10: Submerged Unit Weight and Equivalent Fluid Density

Soil Type	Depth of Layer (feet)	Drained Friction Angle (°)	Submerged Unit Weight (pcf)	At-Rest Earth Pressure Coefficient	Equivalent Fluid Density (psf/ft)
CH (FILL)	0 - 2	19	58	0.67	39
CH	2 – 17/20	19	63	0.67	42
CL	17 - 20	22	63	0.63	40

A triangular stress distribution can be assumed for design purposes. The equivalent fluid density does not include the hydrostatic pressure exerted on the structure. To calculate the hydrostatic water pressure against the structure, an additional triangular stress distribution should be utilized. The hydrostatic water pressure value should be considered additive to the fluid density. These hydrostatic water pressures can be calculated utilizing a unit weight of 63 pcf starting at the ground surface.

4.5.3 Uplift

The detention vault will be subjected to hydrostatic uplift pressures specifically during times of low water within the well or when the structure is experiencing minimal loading conditions. Provisions should be made to prevent the upward movement of the structure. During the end of construction and post construction while the sanitary lift station is in use, the following formula should be utilized to calculate a factor of safety against uplift.

All structures shall be designed to resist buoyancy to the finished top slab. Structural design and buoyancy calculations must show a minimum Factor of Safety (FOS) equal to or greater than 1.5 against flotation for an empty structure with the groundwater elevation at the surface. Groundwater used for uplift calculations (PU) should also consider anticipated flood levels for the site with a minimum FOS of 1.1 for extreme cases.

Uplift forces resisted by the dead weight of the detention vault structure should consider an empty condition. Dead loads from equipment and pumps should be neglected. We recommend the calculated ultimate uplift resistance due to the weight of the structure be reduced by a factor of 1.2 to compute the allowable uplift resistance. The structure weight should include only the concrete walls and slab and can be taken as 145 pcf. We recommend an allowable side skin friction of 550 psf when considering uplift resistance. The skin friction component should be neglected if a bentonite slurry is applied to the outside of the caisson during construction to facilitate excavation.

4.6 RETAINING WALL/BELOW-GRADE WALL CONSIDERATIONS

Retaining/below-grade walls should be placed on a slope no steeper than 3H:1V, as defined from the exterior lower footing edge, down to the limit of the slope upon which the retaining wall is built. This requirement is intended to prevent retaining/below-grade walls from being constructed on excessively steep slopes, threatening both the integrity of the retaining wall/below-grade wall, and the slope to be retained.

The values tabulated on the following page under "Active Conditions" pertain to retaining walls less than 6 feet tall and free to tilt outward as a result of lateral earth pressures. For rigid, non-yielding walls (such as detention vault walls) which are not allowed to rotate, the values under "At-Rest Conditions" should be used.

Table 11: Lateral Earth Pressure Design Values for Retaining Wall(s)/Below Grade Wall

BACKFILL TYPE (LEVEL BACKFILL)	ESTIMATED TOTAL UNIT WEIGHT (PCF)	ACTIVE CONDITION		AT REST CONDITION	
		EARTH PRESSURE COEFFICIENT, K_A	EQUIVALENT FLUID DENSITY (PCF)	EARTH PRESSURE COEFFICIENT, K_O	EQUIVALENT FLUID DENSITY (PCF)
Clayey/Silty SAND (SC/SM); PI < 21	120	0.33	40	0.5	60
Pit Run Clayey Gravels or Sands	135	0.32	45	0.48	65
On-Site Clays	120	0.59	70	0.74	90

Retaining/below grade walls, should also account for surcharge loads within a 45° slope from the base of the backside of the wall. In addition, the design pressure outlined above should be modified if a sloping backfill is required. The passive resistance should be neglected in the stability calculations if there is a possibility that the soil in front of the wall footing will be excavated in the future. The retaining wall should have a minimum factor of safety of 1.5 or greater against sliding and overturning. The depth of embedment should be at least 30 inches and a bearing capacity of 2,000 psf can be used for the design of the retaining wall.

The recommendations contained above assume that the backfill behind the wall is properly drained. Drainage of the backfill may be accomplished through the use of 3-inch diameter weep holes at 10-foot spacing, through the wall, immediately above the proposed grade in front of the wall. Alternatively, a longitudinal drain line may be placed behind the retaining wall and sloped to discharge by gravity or to a storm sewer.

Passive lateral pressures at the face of the footing, for resistance purposes, can be 225 psf per foot of soil height. The passive resistance should be ignored for the upper 1 foot of wall. The frictional resistance against sliding (N tan Ø) is 0.33N on natural or compacted soil.

Compaction of the materials placed for the wall should be conducted in accordance with this report and depends on the type of material used. If retaining walls are required as part of this development, we recommend that ECS be consulted during the design phase to evaluate that our recommendations are appropriately applied as well as to determine if a global stability analysis is required.

4.7 PAVEMENT SUBGRADE

Fill soils were encountered to a depth of 2 feet below the existing grade within the project site. Proposed paved areas should be proofrolled with heavy compaction equipment with load of at least 25 tons to identify soft or loose soils so they can be removed and replaced with properly placed and compacted soils. Pumping or rutting identified during proofroll should be conducted in accordance with TxDOT Standard Specification Item 216. The proofrolling operations should be observed by the representative of Geotechnical Engineer of Record.

For estimating purposes, we recommend that 6% hydrated lime (by dry weight of soil) can be considered for subgrade treatment. The application rate will be approximately 27 pounds per square yard for each 6-inch lift of compacted thickness. The actual amount of lime required should be determined by additional laboratory tests (lime series) during the construction phase. The lime treatment should conform TxDOT Item 260. The treated soil should be compacted to a minimum of 95% of its maximum standard Proctor dry density (ASTM D698) at a moisture content within ±2% of optimum moisture content value as determined by that test. Lime treatment should extend at least 1 foot beyond exposed pavement edges to reduce the effects of shrinkage and associated loss of subgrade support.

Density tests should be performed at a frequency of 1 test per 5,000 square feet of pavement. The actual amount of lime required should be confirmed by additional laboratory tests (lime series) during the construction phase.

4.7.1 Pavement Sections

Typical pavement sections are provided below. The Light-Duty and Medium-Duty asphalt pavements with lime treatment are adequate for design life of 50,000 and 100,000 ESAL, respectively. The Light-Duty and Medium-Duty concrete pavements without lime treatment are adequate for design life of 50,000 and 125,000 ESAL, respectively. If chemical treatment is performed beneath concrete pavements, the Standard-Duty and Medium-Duty concrete pavements are adequate for design life of 80,000 and 200,000 ESAL, respectively. Heavy-Duty pavements are recommended for frequent truck traffic areas and dumpster areas. Recommended pavement sections are provided below. Actual pavements sections and joint spacing should be designed based on actual traffic loads by the Civil Engineer of Record.

Table 12: Pavement Sections

MATERIAL DESCRIPTION	ASPHALTIC CONCRETE PAVEMENT		PORTLAND CEMENT CONCRETE (PCC) PAVEMENT		
	AUTOMOBILE LIGHT-DUTY	FIRE LANE MEDIUM-DUTY	AUTOMOBILE LIGHT-DUTY	FIRE LANE MEDIUM-DUTY	DUMPSTER AREA
Asphalt Surface Course	2 inches	2 inches	-	-	-
Asphalt Binder Course[1]	3 inches	4 inches	-	-	-
Portland Cement Concrete	-	-	5 inches	6 inches	7 inches
Lime-Treated Subgrade[2]	-	6 inches	-	6 inches	6 inches
Reworked Subgrade	6 inches	-	6 inches	-	-

[1] Flexible base material may be substituted for the asphalt binder using a substitute ratio of three inches of flexible base for each inch of asphalt binder.
[2] In lieu of lime-treated subgrade, the PCC pavement thickness may be increased by 1 inch.

An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Furthermore, good drainage should reduce the possibility of the subgrade materials becoming saturated during the normal service period of the pavement.

The recommended pavement sections provided above are considered the minimum necessary based on the traffic loading presented above. In some cases, jurisdictional minimum standards for pavement section construction may exceed those provided above. The Civil Engineer of Record and/or the Contractor should check with the local jurisdiction and therefore design and construct per the requirements.

Pavement should be specified, constructed, and tested to meet the following requirements:

1. Reinforcing Steel: Reinforcing steel may consist of #3 reinforcing steel bars placed at 18 inches on-center, each way. Reinforcing steel for trash pickup and dumpster areas may consist of #4 reinforcing steel bars placed at 18 inches on-center, each way. Saw cuts contraction joints should be spaced 15 feet on-center, each way. Expansion joints should be maintained 60 feet apart through the entire depth of pavement. Appropriate jointing should be incorporated into the design of the PCC pavement.

2. Hot Mix Asphaltic Concrete: Item 340 of the TxDOT Standard Specifications, Type A or B Base Course (binder), Type C or D Surface Course. The coarse aggregate in the surface course should be crushed limestone rather than gravel.

3. Portland Cement Concrete: Minimum compressive strength of 3,500 lbs per sq inch at 28 days. Concrete should be designed with 3 to 6 percent entrained air.

4. Flexible Base Material: Item 247 of the TxDOT Standard Specifications, Type A or B, Grade 1-2. The material should be compacted to a minimum 95 percent of standard Proctor maximum dry density (ASTM D698) and within three percentage points of the material's optimum moisture content.

Proper joint placement and design is critical to Portland cement pavement performance. Load transfer at joints and maintenance of watertight joints should be accomplished by use of proper joint seals and dowels. Control joints in new pavement should be sawed as soon as practical and preferably within 5 to 12 hours after placing concrete to control the location of cracks which form as the concrete cures. Longitudinal and transverse control joints should be sawed at spacings not exceeding 15 feet. The depth of the joint should extend at least ¼ of the slab thickness. Joints should be properly cleaned and sealed as soon as possible to avoid infiltration of water, small gravel, etc.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

Good site drainage should be maintained during earthwork operations which will help maintain the integrity of the soil. The surface of the site should be kept properly graded to enhance drainage of the surface water away from the proposed building areas during the construction phase. We recommend that an attempt be made to enhance the natural drainage without interrupting its pattern.

The soils at the site are moisture and disturbance sensitive and contain fines which are considered moderately erodible. Therefore, the contractor should carefully plan his operation to prevent exposure of the subgrade to weather and construction equipment traffic and provide and maintain good site drainage during earthwork operations to help maintain the integrity of the surficial soils. Erosion and sedimentation should be controlled in accordance with sound engineering practice and current jurisdictional requirements.

We recommend that the upper six inches of subgrade soils beneath buildings, pavements, and concrete flatwork be compacted to at least 95% of standard density (ASTM D698) at a moisture content within 0 to +3% of optimum value. Positive drainage should always be maintained to drain surface water away from the structure.

5.1.1 Stripping and Grubbing

In preparing the site for construction, loose, existing pavement, poorly compacted existing soils, vegetation, organic soil, foundations or utilities (if encountered), poorly compacted soil or other yielding materials should be removed from proposed building and paving areas and areas receiving new fill. Tree trunks, tree roots, root balls/root mats should be removed during the clearing and grubbing. These areas should be backfilled with select fill soils. We recommend that the stripping depth be evaluated at the time of construction by a geotechnical professional.

5.1.2 Proofrolling

After stripping and removing inadequate surface materials, cutting to the proposed grade, and prior to the placement of fill or placing other construction materials, the exposed subgrade in building and pavement areas should be observed by ECS. The exposed subgrade should be proofrolled in accordance with TxDOT Standard Specification Item 216 with construction equipment having a minimum axle load of 25 tons (e.g., fully loaded tandem-axle dump truck). Proofrolling should traverse the areas by the equipment in two perpendicular (orthogonal) directions with overlapping passes of the vehicle under the observation of ECS. This procedure is intended to assist in identifying localized yielding materials. The proofrolling operations should be observed by the representative of Geotechnical Engineer of Record. If yielding or “pumping” subgrade is identified by the proofrolling, those areas should be marked for repair prior to the placement of subsequent fill or other construction materials. Subgrade repair methods, such as undercutting or moisture conditioning or chemical treatment, should be discussed with ECS to determine appropriate procedures to mitigate the conditions causing the yielding.

5.2 EARTHWORK OPERATIONS

If the onsite clays become wet, it may be difficult to access and perform earthwork and other construction activities. Should this condition develop, drying of the soils for support of pavement and floor slabs may be improved by the addition of 4% lime by dry weight, as a minimum. The application rate corresponding to this additive amount would be approximately 18 pounds per square yard for each six-inch lift of compacted thickness. Texas Department of Transportation (TxDOT) Specifications, Items 260, should be used as procedural guides for placing, mixing, and compacting lime and the soils.

Prior to placement of new fill, subgrades should be scarified to a minimum depth of 6 inches, moisture conditioned and compacted to at least 95% of maximum dry density as obtained by the standard Proctor method (ASTM D698) moisture conditioned within optimum and +3% above optimum value.

Soil moisture levels should be preserved (by various methods that can include covering with plastic, watering, etc.) until new fill, pavements or slabs are placed. Fill soils should be placed in maximum 8-inch loose lifts for mass grading operations and 4 inches for trench excavations where walk behind or "jumping jack" compaction equipment is used.

Upon completion of the filling operations, care should be taken to maintain the soil moisture content prior to construction of floor slabs and pavements. If the soil becomes desiccated, the affected material should be removed and replaced, or these materials should be scarified, moisture conditioned and recompacted.

Utility cuts should not be left open for extended periods of time and should be properly backfilled. Backfilling should be accomplished with properly compacted on-site soils, rather than granular materials. If granular materials are used, a utility trench cut-off at the building line is recommended to help prevent water from migrating through the utility trench backfill to beneath the proposed structure.

Field density and moisture tests should be performed on each lift as necessary to verify that adequate compaction is achieved. As a guide, one test per 2,500 square feet per lift is recommended in the foundation and slab area and one test per 5,000 square feet per lift in the paving areas (two tests minimum per lift). Utility trench backfill should be tested at a rate of one test per lift every 150 linear feet of trench (two tests minimum per lift). Certain jurisdictional requirements may require testing in addition to that noted previously. Therefore, these specifications should be reviewed, and the more stringent specifications should be followed.

5.3 MATERIAL SPECIFICATIONS

5.3.1 General Fill

General fill should consist of on-site or imported soils, provided they meet the requirements described below. General fill materials should be free of organics, construction debris, deleterious materials, and should be free of rocks larger than 4 inches in greatest dimension. Existing soils encountered in our soil borings can be used as general fill provided oversize materials, organics, debris, and deleterious materials are cleaned out. ECS should observe the cleaning of the existing soils on-site on a full-time basis prior to re-use. Proposed general fill should be evaluated and tested by ECS prior to placement in the field.

ECS recommends that general fill be placed in horizontal loose lifts of not more than 8 inches in thickness. Lift thickness should be decreased when using light compaction equipment. General fill should be compacted to at least 95% of the maximum dry density at moisture contents within the range of optimum to +4 percentage points of the optimum moisture content (ASTM D698).

5.3.2 Select Fill

For the purposes of this report, select fill soil may consist of imported material that is free of debris and organic matter and have a Plasticity Index (PI) of ranging 10 to 20 and liquid limit of less than 40. Based on the limited laboratory test results, the on-site soils should not meet the requirement to be used as select fill.

This material should be placed and compacted at workable moisture contents within optimum and +3% above optimum value and compacted to at least 95% of the maximum dry density as obtained using the standard Proctor method (ASTM D698).

5.3.3 Lime-Treated On-site Clay

In lieu of importing select fill, as defined above, the on-site clay soils may be lime treated. The advantage to lime treatment over untreated select fill is the nearly "weatherproof" nature of the soil and once placed and compacted the material essentially retains the virtually impermeable nature of the parent clay, minimizing water infiltration beneath the building.

A preliminary lime application rate of between 6% hydrated lime by dry weight of clay should be used for budgeting purposes. The application rate corresponding to this additive amount would be between approximately 27 pounds per square yard for each six inches of compacted thickness. The actual amount of lime required should be confirmed by additional laboratory tests (lime series) during the construction phase by the authorized representative of the Geotechnical Engineer of Record (GER).

The lime-treated clay should be mixed and appropriately mellowed for at least 48 hours and tested for gradation and lime solubility (pH) prior to final placement and compaction. Once appropriately mixed and mellowed, this material may then be placed and compacted at workable moisture contents above the optimum moisture content and compacted to at least 95% of the maximum dry density as obtained using the standard Proctor method (ASTM D698).

5.3.4 Moisture-Conditioned On-Site Clay Fill

Within the planned building pad, and flatwork sensitive to movements, moisture conditioning should be performed as outlined in this report. Reworking of the existing clays, clay soils from the excavation areas, and new clayey fill, is performed to increase the moisture of the clays to a level that reduces their ability to absorb additional water that could result in post-construction heave in these soils.

The moisture conditioning should consist of undercutting, scarifying and/or reworking, as required to achieve the required subgrade improvement. During this process, the clay should receive adequate amounts of water to ensure a uniform moisture content of at least 4% or higher above the optimum moisture content. During the addition of water, the soils should be adequately mixed, and re-mixed, to

ensure a uniform distribution of the moisture throughout the soil mass. Once appropriately mixed, the material should be compacted to 92% to 96% of the maximum dry density as obtained using the standard Proctor method (ASTM D698).

Outside of the moisture-conditioned zone and where clay is used to establish site grades, we recommend that this material may be placed and compacted to at least 95% of the maximum dry density as obtained using the standard Proctor method (ASTM D698). These soils should be free of deleterious materials and be reworked to ensure a consistent distribution of water to achieve a consistent moisture content distribution above the optimum value.

Care should be taken to verify and preserve the specified moisture levels in the reworked clays prior to placement of low-expansive fill.

5.4 CONSTRUCTION GROUNDWATER CONTROL

Groundwater was not observed during the field exploration. However, these conditions should be anticipated and can be handled through the use of trenching and pumping. One of the more cost-effective techniques is the prudent utilization of spot drains, and in planning utility installations. For example, utility installation that requires a gravity feed can be effectively converted into a drainage line to help assist in groundwater control during construction.

If groundwater is observed during construction of footings or buried utilities, an ECS geotechnical engineer should be consulted to determine if additional permanent drainage provisions are necessary in the design and construction. Groundwater levels should be maintained no higher than 3 feet below subgrade levels to provide relatively dry working conditions and firm bedding. Sump pumping and surface runoff ditches may be adequate for temporary control of surface runoff and groundwater during construction.

The surface of the site should be kept property graded to enhance drainage of surface water away from the proposed construction area during construction. We recommend that an attempt be made to enhance the natural drainage without interrupting its pattern.

5.5 EXCAVATIONS

Based on soils strength data, temporary (less than 24 hours), open trenched, non-surcharged and unsupported excavations should be built on a slope flatter than 1.5(h):1(v) provided this will not impact the stability of the existing/nearby structures. Flatter slopes may be required in the areas where soft soils or large amounts of sands are encountered. Vertical cuts can be used, provided shoring and bracing is used for excavation wall stability. Benched excavation can also be used with average slopes of about 1(h):1(v) and steps should not be higher than four feet. Excavation construction should conform to OSHA (Occupational Safety and Health Administration) guidelines.

Excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing, constructing, and maintaining stable temporary excavations and slopes. The contractor’s responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor’s safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth,

exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

Excavations should be performed with equipment capable of providing a relatively clean bearing area. Excavation equipment should not disturb the soil beneath the design excavation bottom and should not leave large amounts of loose soil in the excavation. Foundation excavations should be protected against significant change in soil moisture content and disturbance by construction activity and require that water not be allowed to pond in excavations.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by Carlson Consulting Engineers, Inc. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

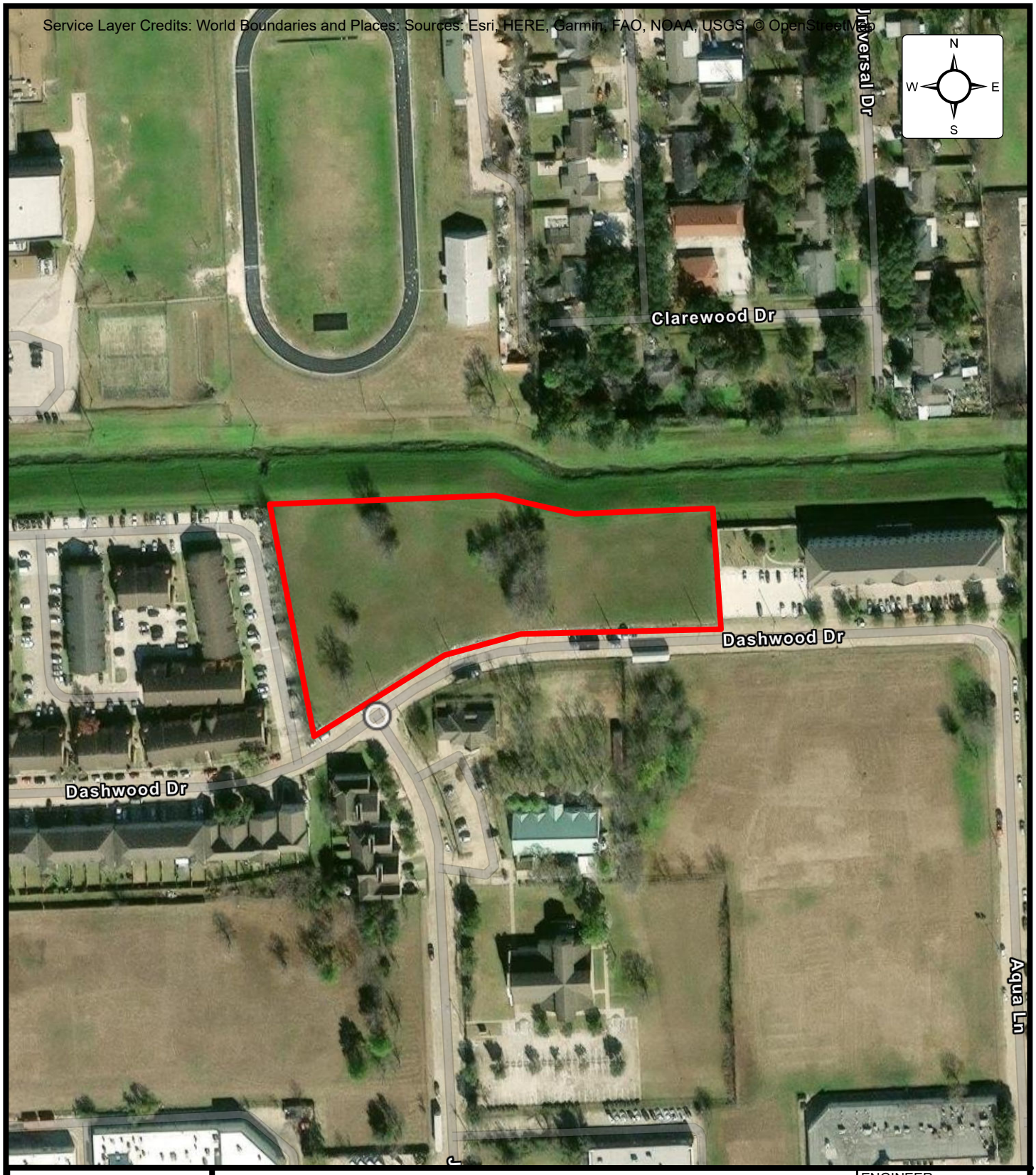
We recommend that ECS be retained to review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation recommendations should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

APPENDIX A – Drawings and Reports

Site Location Diagram
Boring Location Diagram
Subsurface Cross-Section
Historic Aerials
Geological Survey Map
Topographic Map



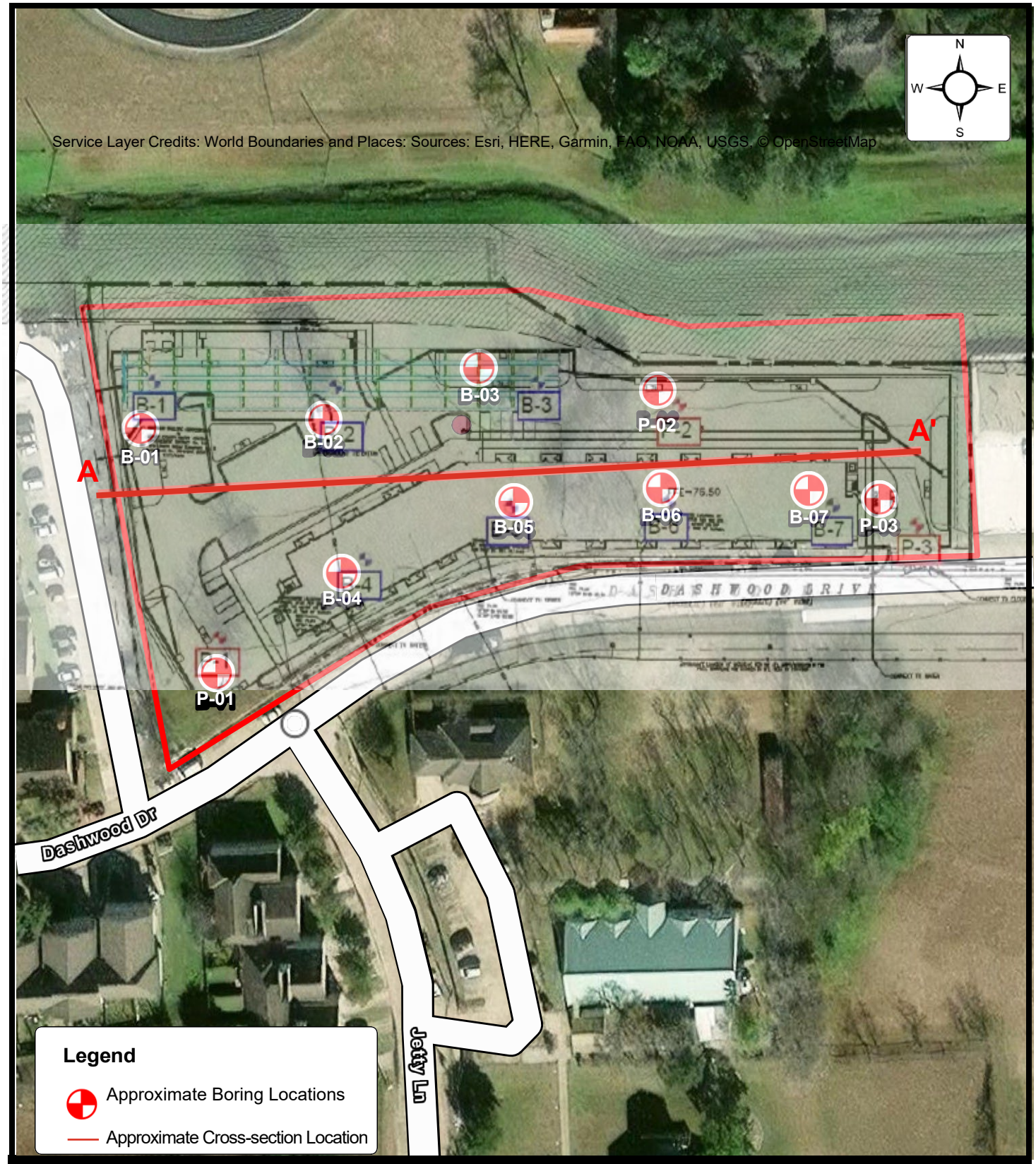
SITE LOCATION DIAGRAM

DASHWOOD TRAILS APARTMENTS

DASHWOOD DRIVE AND JETTY LANE
HOUSTON, HARRIS COUNTY, TEXAS

CARLSON CONSULTING ENGINEERS, INC.

ENGINEER	VY
SCALE	1" = 200'
PROJECT NO.	43:3223
SHEET	
DATE	10/17/2024



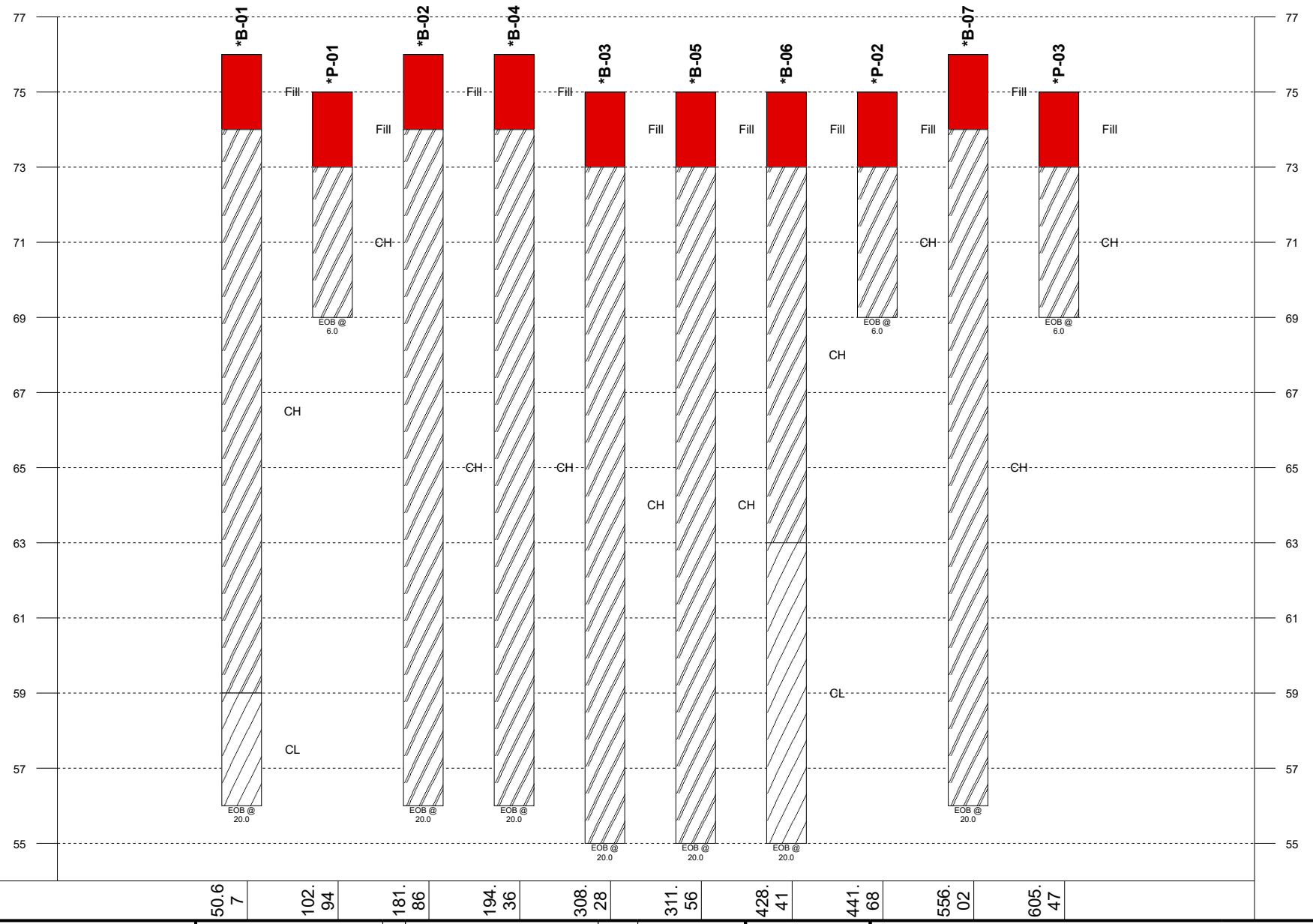
BORING LOCATION DIAGRAM

DASHWOOD TRAILS APARTMENTS

DASHWOOD DRIVE AND JETTY LANE
HOUSTON, HARRIS COUNTY, TEXAS

CARLSON CONSULTING ENGINEERS, INC.

ENGINEER	VY
SCALE	1" = 100'
PROJECT NO.	43:3223
SHEET	
DATE	10/17/2024



Legend Key

- Fill
- CH
- CL

Notes:

1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit X Water Content ● Liquid Limit △	WL (First Encountered)	Fill	
[Fines Content %]	WL (Completion)	Possible Fill	
Bottom of Casing	WL (Estimated Seasonal High Water)	Probable Fill	
Loss of Circulation	WL (Stabilized)	Rock	
Calibrated Penetrometer			

GENERALIZED SUBSURFACE SOIL PROFILE Section Line AA'

Dashwood Trails Apartments

Carlson Consulting Engineers, Inc.

Dashwood Drive and Jetty Lane, Houston, Harris County, Texas 77027

Project No: 43:3223 Date: 10/17/2024

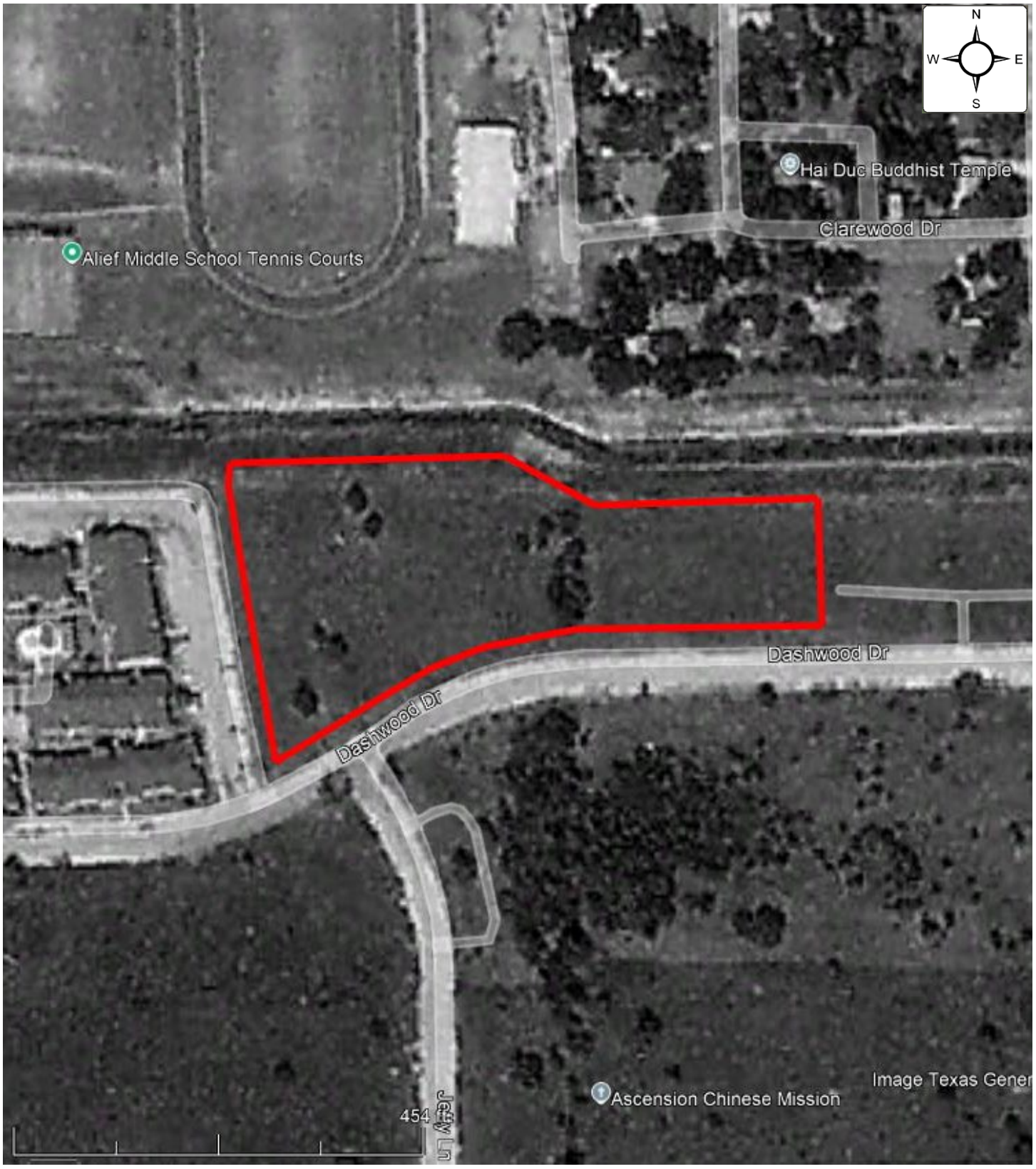
AERIAL PHOTOGRAPH - 1978

DASHWOOD TRAILS APARTMENTS

DASHWOOD DRIVE AND JETTY LANE
HOUSTON, HARRIS COUNTY, TEXAS

CARLSON CONSULTING ENGINEERS, INC.

ENGINEER	VY
SCALE	AS NOTED
PROJECT NO.	43:3223
DATE	10/17/2024



AERIAL PHOTOGRAPH - 1989

DASHWOOD TRAILS APARTMENTS

DASHWOOD DRIVE AND JETTY LANE
HOUSTON, HARRIS COUNTY, TEXAS

CARLSON CONSULTING ENGINEERS, INC.

ENGINEER	VY
SCALE	AS NOTED
PROJECT NO.	43:3223
DATE	10/17/2024

AERIAL PHOTOGRAPH - 2005

DASHWOOD TRAILS APARTMENTS

DASHWOOD DRIVE AND JETTY LANE
HOUSTON, HARRIS COUNTY, TEXAS

CARLSON CONSULTING ENGINEERS, INC.

ENGINEER	VY
SCALE	AS NOTED
PROJECT NO.	43:3223
DATE	10/17/2024

AERIAL PHOTOGRAPH - 2009

DASHWOOD TRAILS APARTMENTS

DASHWOOD DRIVE AND JETTY LANE
HOUSTON, HARRIS COUNTY, TEXAS

CARLSON CONSULTING ENGINEERS, INC.

ENGINEER	VY
SCALE	AS NOTED
PROJECT NO.	43:3223
DATE	10/17/2024

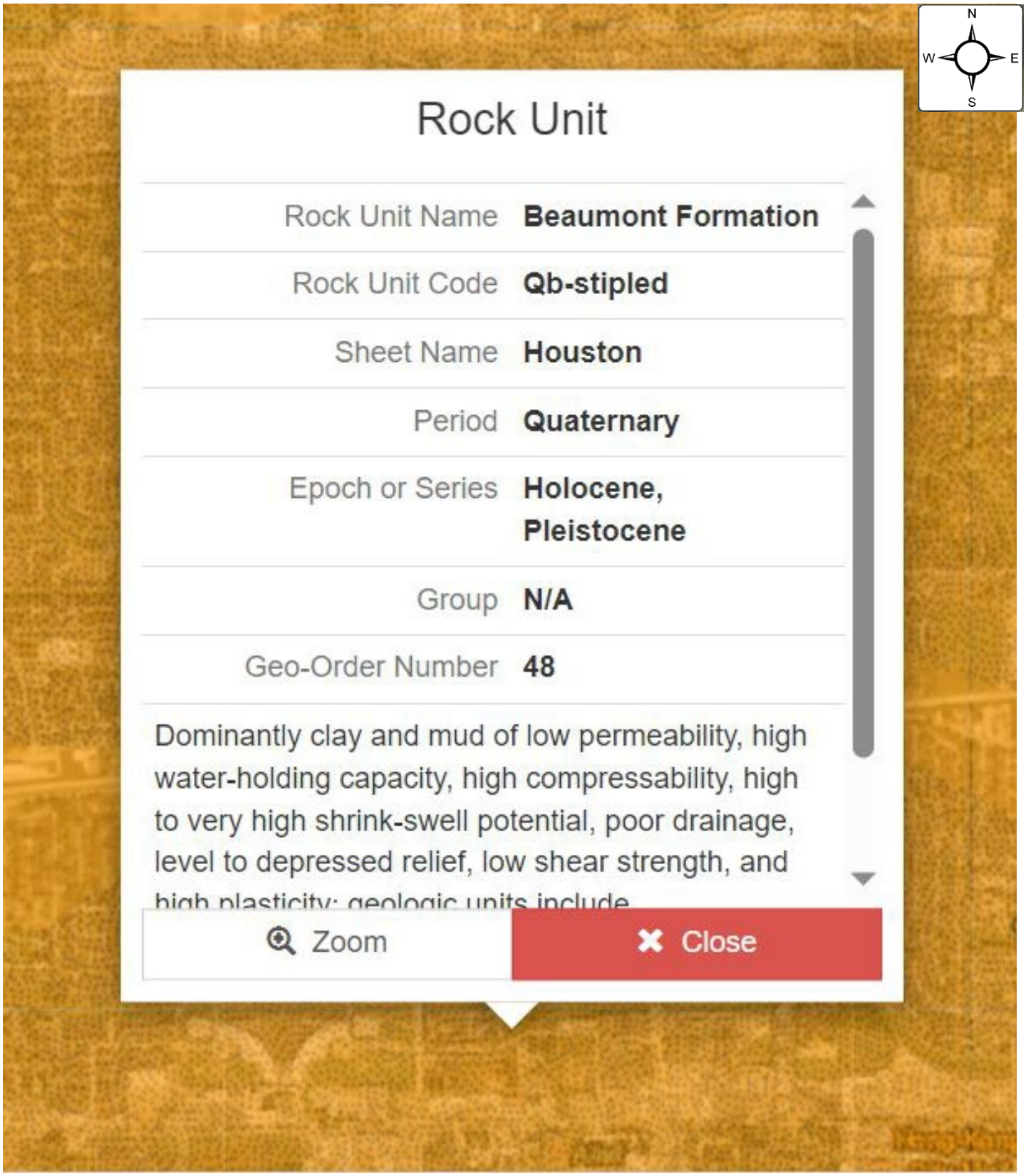
AERIAL PHOTOGRAPH - 2024

DASHWOOD TRAILS APARTMENTS

DASHWOOD DRIVE AND JETTY LANE
HOUSTON, HARRIS COUNTY, TEXAS

CARLSON CONSULTING ENGINEERS, INC.

ENGINEER	VY
SCALE	AS NOTED
PROJECT NO.	43:3223
DATE	10/17/2024



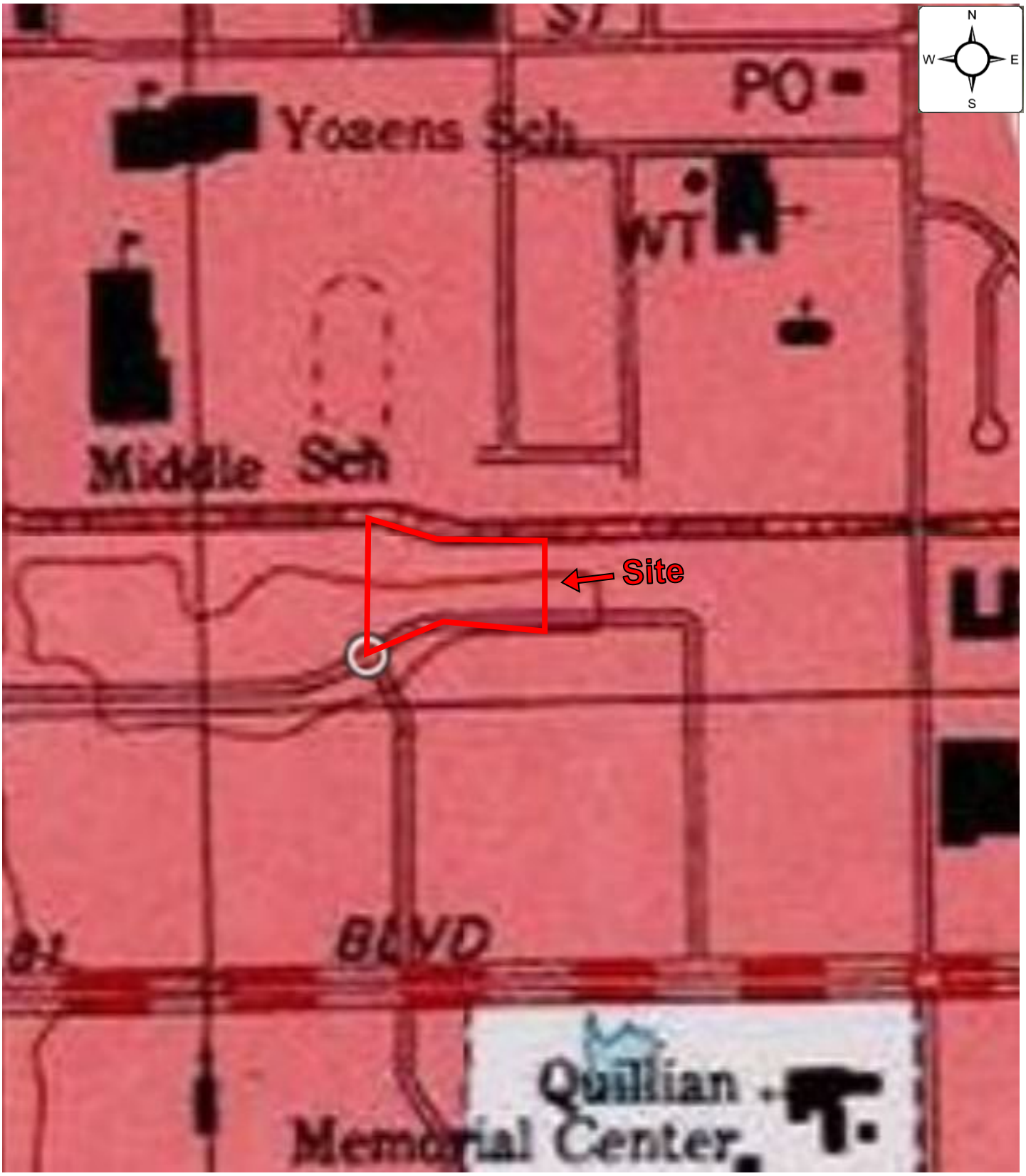
REGIONAL GEOLOGY MAP

DASHWOOD TRAILS APARTMENTS

DASHWOOD DRIVE AND JETTY LANE
HOUSTON, HARRIS COUNTY, TEXAS

CARLSON CONSULTING ENGINEERS, INC.

ENGINEER	VY
SCALE	NTS
PROJECT NO.	43:3223
DATE	10/17/2024



TOPOGRAPHIC MAP

DASHWOOD TRAILS APARTMENTS

DASHWOOD DRIVE AND JETTY LANE
HOUSTON, HARRIS COUNTY, TEXAS

CARLSON CONSULTING ENGINEERS, INC.

ENGINEER	VY
SCALE	NTS
PROJECT NO.	43:3223
DATE	10/17/2024

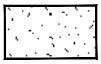
APPENDIX B – Field Operations

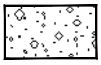
Reference Notes for Boring Logs
Subsurface Exploration Procedure
Boring Logs

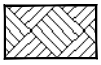
REFERENCE NOTES FOR BORING LOGS

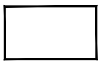
MATERIAL[1,2]

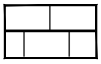
ASPHALT


CONCRETE


GRAVEL


TOPSOIL

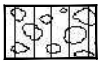

VOID


BRICK

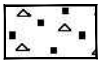
AGGREGATE BASE COURSE

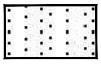
GW **WELL-GRADED GRAVEL**
gravel-sand mixtures, little or no fines

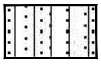
GP **POORLY-GRADED GRAVEL**
gravel-sand mixtures, little or no fines

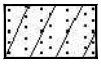

GM **SILTY GRAVEL**
gravel-sand-silt mixtures

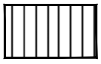
GC **CLAYEY GRAVEL**
gravel-sand-clay mixtures

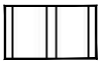

SW **WELL-GRADED SAND**
gravelly sand, little or no fines


SP **POORLY-GRADED SAND**
gravelly sand, little or no fines


SM **SILTY SAND**
sand-silt mixtures

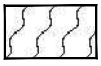

SC **CLAYEY SAND**
sand-clay mixtures

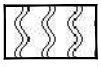

ML **SILT**
non-plastic to medium plasticity

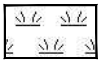

MH **ELASTIC SILT**
high plasticity

CL **LEAN CLAY**
low to medium plasticity

CH **FAT CLAY**
high plasticity


OL **ORGANIC SILT or CLAY**
non-plastic to low plasticity


OH **ORGANIC SILT or CLAY**
high plasticity


PT **PEAT**
highly organic soils

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, Q_P[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[5]	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective *(ex: "Silty")*	25 - 45	30 - 45

WATER LEVELS[6]

WL (First Encountered)

WL (Completion)

WL (Seasonal High Water)

WL (Stabilized)

FILL AND ROCK

FILL | POSSIBLE FILL | PROBABLE FILL | ROCK

[1]Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

[2]To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

[3]Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

[4]Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[5]Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[6]The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

[7]Minor deviation from ASTM D 2488-17 Note 14.

[8]Percentages are estimated to the nearest 5% per ASTM D 2488-17.

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SUBSURFACE EXPLORATION PROCEDURE

The field exploration was planned with the objective of characterizing the project site in general geotechnical and geological terms and to evaluate subsequent field and laboratory data to assist in the determination of geotechnical recommendations.

The subsurface conditions were explored by ten borings drilled to completion depths between 6 feet to 20 feet below the existing site grade. A truck-mounted drill rig with solid-stem, continuous-flight augers was utilized to drill the borings.

The approximate as-drilled boring locations are shown on the Boring Location Diagram in Appendix A. The ground surface elevations noted in this report were obtained from the available public data sources and may not be accurate enough for engineering purposes.

Representative soil samples were obtained by means of the Shelby tube sampling procedures in general accordance with ASTM D1587. In the Shelby tube sampling procedure, a thin walled, steel, seamless tube with sharp cutting edges is pushed hydraulically into the soil, and a relatively undisturbed sample is obtained.

Field logs of the soils encountered in the borings were maintained by the drill crew. After recovery, each geotechnical soil sample was removed from the sampler and visually classified. Representative portion of the soil samples were then wrapped in plastic and transported to our laboratory for further visual examination and laboratory testing. After completion of the drilling operations, the boreholes were backfilled with auger cuttings to the existing ground surface.

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Carlson Consulting Engineers, Inc.	**43:3223**	**B-01**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Dashwood Trails Apartments	**Herman Drilling Corporation**

SITE LOCATION: **Dashwood Drive and Jetty Lane, Houston, Texas 77072**

LOSS OF CIRCULATION

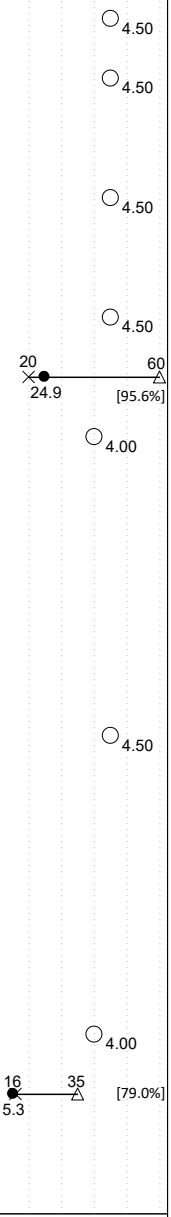
LATITUDE:	LONGITUDE:	STATION:	SURFACE ELEVATION:
29.706871	**-95.593212**		**76.0' MSL**

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
	S-1	ST	24		(CH FILL) FAT CLAY FILL, Dark Gray and Dark Brown, Hard, Trace Root Fibers and Gravel			
	S-2	ST	24		(CH) FAT CLAY WITH SAND, Dark Gray, Dark Brown and Reddish Brown, Hard, with Ferrous and Calcareous Nodules			
5	S-3	ST	24				71	
	S-4	ST	24					
	S-5	ST	24					
10							66	
	S-6	ST	24					
15							61	
	S-7	ST	24		(CL) LEAN CLAY WITH SAND, Dark Gray and Reddish Brown, Hard, with Ferrous Nodules and Sand Seams			
20					**END OF BORING AT 20.0 FT**		56	

STANDARD PENETRATION BLOWS/FT (10 20 30 40 50 / 20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT (10 20 30 40 50)
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT %
[FINES CONTENT] % (10 20 30 40 50)



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Sep 05 2024**	CAVE IN DEPTH:	**N/A**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Sep 05 2024**	HAMMER TYPE:	**Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **Truck**	LOGGED BY: **HDC**	DRILLING METHOD:	**ASTM D1587**
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Carlson Consulting Engineers, Inc.	**43:3223**	**B-02**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
Dashwood Trails Apartments	**Herman Drilling Corporation**		
SITE LOCATION: **Dashwood Drive and Jetty Lane, Houston, Texas 77072**			LOSS OF CIRCULATION
LATITUDE: **29.706847**	LONGITUDE: **-95.592797**	STATION:	SURFACE ELEVATION: **76.0' MSL**
			BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
	S-1	ST	24		(CH FILL) FAT CLAY FILL, Dark Gray and Dark Brown, Hard, Trace Root Fibers and Gravel			
	S-2	ST	24		(CH) FAT CLAY WITH SAND, Dark Gray, Dark Brown and Reddish Brown, Hard, with Ferrous and Calcareous Nodules			
5	S-3	ST	24				71	
	S-4	ST	24					
	S-5	ST	24					
10							66	
	S-6	ST	24					
15							61	
	S-7	ST	24					
20					**END OF BORING AT 20.0 FT**		56	

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50 | 20 40 60 80 100
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT: 10 20 30 40 50
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF: 1 2 3 4 5
WATER CONTENT %
[FINES CONTENT] %: 10 20 30 40 50

4.50
4.50
4.50
4.50
4.50
20 60
24.7 [90.0%]
4.50
4.50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered) **Dry**	BORING STARTED: **Sep 05 2024**		CAVE IN DEPTH: **N/A**	
WL (Completion) **Dry**	BORING COMPLETED: **Sep 05 2024**		HAMMER TYPE: **Auto**	
WL (Seasonal High Water)	EQUIPMENT: **Truck**	LOGGED BY: **HDC**	DRILLING METHOD: **ASTM D1587**	
WL (Stabilized)				

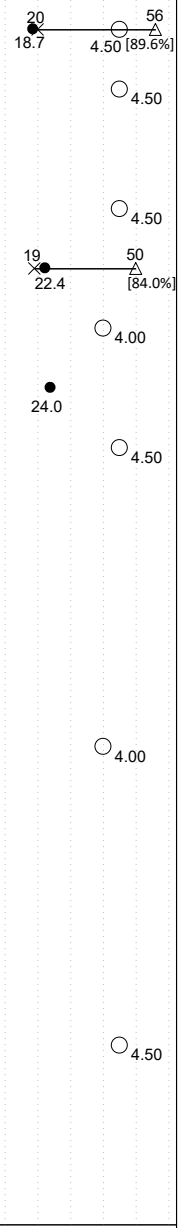
GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Carlson Consulting Engineers, Inc.	**43:3223**	**B-03**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
Dashwood Trails Apartments	**Herman Drilling Corporation**		
SITE LOCATION: **Dashwood Drive and Jetty Lane, Houston, Texas 77072**			LOSS OF CIRCULATION
LATITUDE: **29.706938**	LONGITUDE: **-95.592405**	STATION:	SURFACE ELEVATION: **75.0' MSL**
			BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
0	S-1	ST	24		(CH FILL) FAT CLAY WITH SAND FILL, Dark Gray and Dark Brown, Hard, Trace Root Fibers and Gravel		75	
	S-2	ST	24		(CH) FAT CLAY WITH SAND, Dark Gray, Dark Brown and Reddish Brown, Very Stiff to Hard, with Ferrous and Calcareous Nodules			
5	S-3	ST	24				70	
	S-4	ST	24		**- Dry Unit Weight = 100.0 pcf & Su = 1.72 tsf**			
	S-5	ST	24					
10							65	
	S-6	ST	24					
15							60	
	S-7	ST	24					
20					**END OF BORING AT 20.0 FT**		55	

STANDARD PENETRATION BLOWS/FT (10 20 30 40 50 / 20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT (10 20 30 40 50)
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT %
[FINES CONTENT] % (10 20 30 40 50)



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	**Dry**	BORING STARTED:	**Sep 05 2024**	CAVE IN DEPTH:	**N/A**
WL (Completion)	**Dry**	BORING COMPLETED:	**Sep 05 2024**	HAMMER TYPE:	**Auto**
WL (Seasonal High Water)		EQUIPMENT: **Truck**	LOGGED BY: **HDC**	DRILLING METHOD:	**ASTM D1587**
WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Carlson Consulting Engineers, Inc.	**43:3223**	**B-04**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
Dashwood Trails Apartments	**Herman Drilling Corporation**		
SITE LOCATION:			LOSS OF CIRCULATION
Dashwood Drive and Jetty Lane, Houston, Texas 77072			
LATITUDE:	LONGITUDE:	STATION:	SURFACE ELEVATION:
29.706550	**-95.592737**		**76.0' MSL**

BOTTOM OF CASING

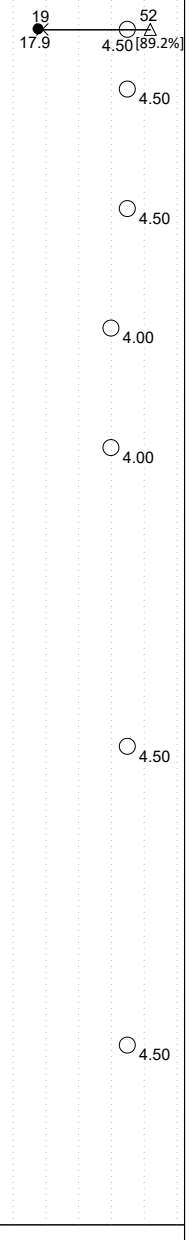
DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
0	S-1	ST	24		(CH FILL) FAT CLAY WITH SAND FILL, Dark Gray and Dark Brown, Hard, Trace Root Fibers and Gravel		76	
	S-2	ST	24		(CH) FAT CLAY, Dark Gray, Dark Brown and Reddish Brown, Hard, with Ferrous and Calcareous Nodules			
5	S-3	ST	24				71	
	S-4	ST	24					
	S-5	ST	24					
10							66	
	S-6	ST	24					
15							61	
	S-7	ST	24					
20					**END OF BORING AT 20.0 FT**		56	

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50 | 20 40 60 80 100
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT: 10 20 30 40 50
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT

CALIBRATED PENETROMETER TSF: 1 2 3 4 5

WATER CONTENT %
[FINES CONTENT] %: 10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	**Dry**	BORING STARTED: **Sep 05 2024**		CAVE IN DEPTH: **N/A**
WL (Completion)	**Dry**	BORING COMPLETED: **Sep 05 2024**		HAMMER TYPE: **Auto**
WL (Seasonal High Water)		EQUIPMENT: **Truck**	LOGGED BY: **HDC**	DRILLING METHOD: **ASTM D1587**
WL (Stabilized)				

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Carlson Consulting Engineers, Inc.	**43:3223**	**B-05**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
Dashwood Trails Apartments	**Herman Drilling Corporation**		
SITE LOCATION: **Dashwood Drive and Jetty Lane, Houston, Texas 77072**			LOSS OF CIRCULATION
LATITUDE: **29.706669**	LONGITUDE: **-95.592376**	STATION:	SURFACE ELEVATION: **75.0' MSL**
			BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
0	S-1	ST	24		(CH FILL) FAT CLAY FILL, Dark Gray and Dark Brown, Hard, Trace Root Fibers and Gravel		75	
	S-2	ST	24		(CH) FAT CLAY WITH SAND, Dark Gray, Dark Brown and Reddish Brown, Very Stiff to Hard, with Ferrous and Calcareous Nodules			
5	S-3	ST	24				70	
	S-4	ST	24					
	S-5	ST	24		***- Dry Unit Weight = 98.2 pcf & Su = 1.37 tsf***			
10							65	
	S-6	ST	24					
15							60	
	S-7	ST	24					
20					**END OF BORING AT 20.0 FT**		55	

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50 / 20 40 60 80 100
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT: 10 20 30 40 50
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF: 1 2 3 4 5
WATER CONTENT %
[FINES CONTENT] %: 10 20 30 40 50

4.50
4.50
21 61
23.2 [94.5%]
4.50
4.50
21 66
24.8 [93.5%]
4.50
25.9
4.50
4.50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	**Dry**	BORING STARTED: **Sep 05 2024**		CAVE IN DEPTH: **N/A**
WL (Completion)	**Dry**	BORING COMPLETED: **Sep 05 2024**		HAMMER TYPE: **Auto**
WL (Seasonal High Water)		EQUIPMENT: **Truck**	LOGGED BY: **HDC**	DRILLING METHOD: **ASTM D1587**
WL (Stabilized)				

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Carlson Consulting Engineers, Inc.	**43:3223**	**B-06**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Dashwood Trails Apartments	**Herman Drilling Corporation**

SITE LOCATION: **Dashwood Drive and Jetty Lane, Houston, Texas 77072**

LOSS OF CIRCULATION

LATITUDE:	LONGITUDE:	STATION:	SURFACE ELEVATION:
29.706671	**-95.592008**		**75.0' MSL**

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
0	S-1	ST	24		(CL FILL) LEAN CLAY FILL, Dark Gray and Dark Brown, Hard, Trace Gravel and Sand Seams		75	
	S-2	ST	24		(CH) FAT CLAY, Dark Gray, Dark Brown and Reddish Brown, Very Stiff to Hard, with Ferrous and Calcareous Nodules			
5	S-3	ST	24				70	
	S-4	ST	24					
	S-5	ST	24					
10					(CL) LEAN CLAY WITH SAND, Dark Gray and Reddish Brown, Hard, with Ferrous Nodules and Sand Seams		65	
	S-6	ST	24					
15							60	
	S-7	ST	24					
20					**END OF BORING AT 20.0 FT**		55	

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50
ROCK QUALITY DESIGNATION & RECOVERY: 20 40 60 80 100
RQD
REC
MC SAMPLER BLOWS/FT: 10 20 30 40 50
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF: 1 2 3 4 5
WATER CONTENT %
[FINES CONTENT] %: 10 20 30 40 50

4.50
4.00
3.50
3.50
4.00
4.50
18 47
19.3 [79.0%]
4.50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	**Dry**	BORING STARTED:	**Sep 05 2024**	CAVE IN DEPTH:	**N/A**
WL (Completion)	**Dry**	BORING COMPLETED:	**Sep 05 2024**	HAMMER TYPE:	**Auto**
WL (Seasonal High Water)		EQUIPMENT: **Truck**	LOGGED BY: **HDC**	DRILLING METHOD:	**ASTM D1587**
WL (Stabilized)					

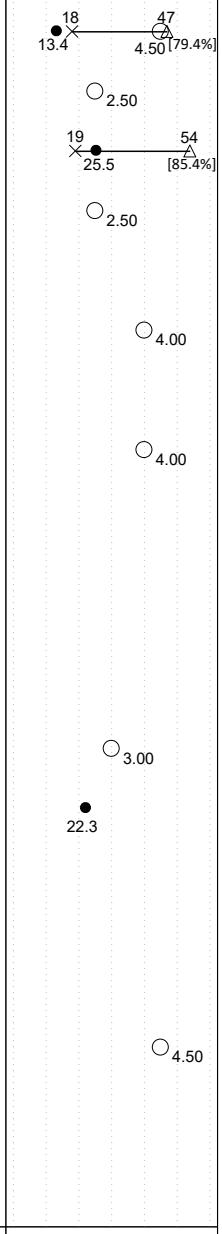
GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Carlson Consulting Engineers, Inc.	**43:3223**	**B-07**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
Dashwood Trails Apartments	**Herman Drilling Corporation**		
SITE LOCATION: **Dashwood Drive and Jetty Lane, Houston, Texas 77072**			LOSS OF CIRCULATION
LATITUDE: **29.706672**	LONGITUDE: **-95.591606**	STATION:	SURFACE ELEVATION: **76.0' MSL**
			BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
0	S-1	ST	24		(CL FILL) LEAN CLAY WITH SAND FILL, Dark Gray and Dark Brown, Hard, Trace Gravel and Sand Seams		76	
	S-2	ST	24		(CH) FAT CLAY WITH SAND, Dark Gray, Dark Brown and Reddish Brown, Very Stiff to Hard, with Ferrous and Calcareous Nodules			
5	S-3	ST	24				71	
	S-4	ST	24					
	S-5	ST	24					
10							66	
	S-6	ST	24		***- Dry Unit Weight = 105.6 pcf & Su = 0.66 tsf***			
15							61	
	S-7	ST	24					
20					**END OF BORING AT 20.0 FT**		56	

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50 | 20 40 60 80 100
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT: 10 20 30 40 50
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF: 1 2 3 4 5
WATER CONTENT %
[FINES CONTENT] %: 10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**Dry**	BORING STARTED: **Sep 05 2024**		CAVE IN DEPTH: **N/A**
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Sep 05 2024**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **Truck**	LOGGED BY: **HDC**	DRILLING METHOD: **ASTM D1587**
▽ WL (Stabilized)				

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Carlson Consulting Engineers, Inc.	**43:3223**	**P-01**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
Dashwood Trails Apartments	**Herman Drilling Corporation**		
SITE LOCATION:			LOSS OF CIRCULATION
Dashwood Drive and Jetty Lane, Houston, Texas 77072			
LATITUDE:	LONGITUDE:	STATION:	SURFACE ELEVATION:
29.706333	**-95.593010**		**75.0' MSL**

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
0	S-1	ST	24		(CL FILL) LEAN CLAY WITH SAND FILL, Dark Gray and Dark Brown, Hard, Trace Gravel and Sand Seams		75	
	S-2	ST	24		(CH) FAT CLAY, Dark Gray and Dark Brown, Hard, with Ferrous and Calcareous Nodules			
5	S-3	ST	24				70	
					END OF BORING AT 6.0 FT			
10							65	
15							60	
20							55	

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50 | 20 40 60 80 100
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT: 10 20 30 40 50
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF: 1 2 3 4 5
WATER CONTENT %
[FINES CONTENT] %: 10 20 30 40 50

18 47
17.5 4.50 [77.7%]
4.50
4.50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	**Dry**	BORING STARTED:	**Sep 05 2024**	CAVE IN DEPTH:	**N/A**
WL (Completion)	**Dry**	BORING COMPLETED:	**Sep 05 2024**	HAMMER TYPE:	**Auto**
WL (Seasonal High Water)		EQUIPMENT: **Truck**	LOGGED BY: **HDC**	DRILLING METHOD:	**ASTM D1587**
WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Carlson Consulting Engineers, Inc.	**43:3223**	**P-02**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Dashwood Trails Apartments	**Herman Drilling Corporation**

SITE LOCATION: **Dashwood Drive and Jetty Lane, Houston, Texas 77072**

LOSS OF CIRCULATION

LATITUDE:	LONGITUDE:	STATION:	SURFACE ELEVATION:
29.706856	**-95.591979**		**75.0' MSL**

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
0	S-1	ST	24		(CL FILL) LEAN CLAY FILL, Dark Gray and Dark Brown, Hard, Trace Gravel and Sand Seams		75	
	S-2	ST	24		(CH) FAT CLAY WITH SAND, Dark Gray and Dark Brown, Hard, with Ferrous and Calcareous Nodules			
5	S-3	ST	24				70	
					END OF BORING AT 6.0 FT			
10							65	
15							60	
20							55	

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50
20 40 60 80 100
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT
10 20 30 40 50
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF
1 2 3 4 5
WATER CONTENT %
[FINES CONTENT] %
10 20 30 40 50

4.50
4.25
20 58
23.7 [84.9%]
4.00

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	**Dry**	BORING STARTED:	**Sep 05 2024**	CAVE IN DEPTH:	**N/A**
WL (Completion)	**Dry**	BORING COMPLETED:	**Sep 05 2024**	HAMMER TYPE:	**Auto**
WL (Seasonal High Water)		EQUIPMENT: **Truck**	LOGGED BY: **HDC**	DRILLING METHOD:	**ASTM D1587**
WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Carlson Consulting Engineers, Inc.	**43:3223**	**P-03**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
Dashwood Trails Apartments	**Herman Drilling Corporation**		
SITE LOCATION: **Dashwood Drive and Jetty Lane, Houston, Texas 77072**			LOSS OF CIRCULATION
LATITUDE: **29.706626**	LONGITUDE: **-95.591447**	STATION:	SURFACE ELEVATION: **75.0' MSL**
			BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
0	S-1	ST	24		(CL FILL) LEAN CLAY WITH SAND FILL, Dark Gray and Dark Brown, Hard, Trace Gravel and Sand Seams		75	
	S-2	ST	24		(CH) FAT CLAY, Dark Gray and Dark Brown, Hard, with Ferrous and Calcareous Nodules			
5	S-3	ST	24				70	
					END OF BORING AT 6.0 FT			
10							65	
15							60	
20							55	

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50
ROCK QUALITY DESIGNATION & RECOVERY: 20 40 60 80 100
RQD
REC
MC SAMPLER BLOWS/FT: 10 20 30 40 50
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF: 1 2 3 4 5
WATER CONTENT %
[FINES CONTENT] %: 10 20 30 40 50

18 47
18.4 4.50 [78.3%]
4.50
4.50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	**Dry**	BORING STARTED:	**Sep 05 2024**	CAVE IN DEPTH:	**N/A**
WL (Completion)	**Dry**	BORING COMPLETED:	**Sep 05 2024**	HAMMER TYPE:	**Auto**
WL (Seasonal High Water)		EQUIPMENT: **Truck**	LOGGED BY: **HDC**	DRILLING METHOD:	**ASTM D1587**
WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

APPENDIX C – Laboratory Testing

Laboratory Testing Summary
Unconsolidated-Undrained (UU) Compressive Strength

Laboratory Testing Summary

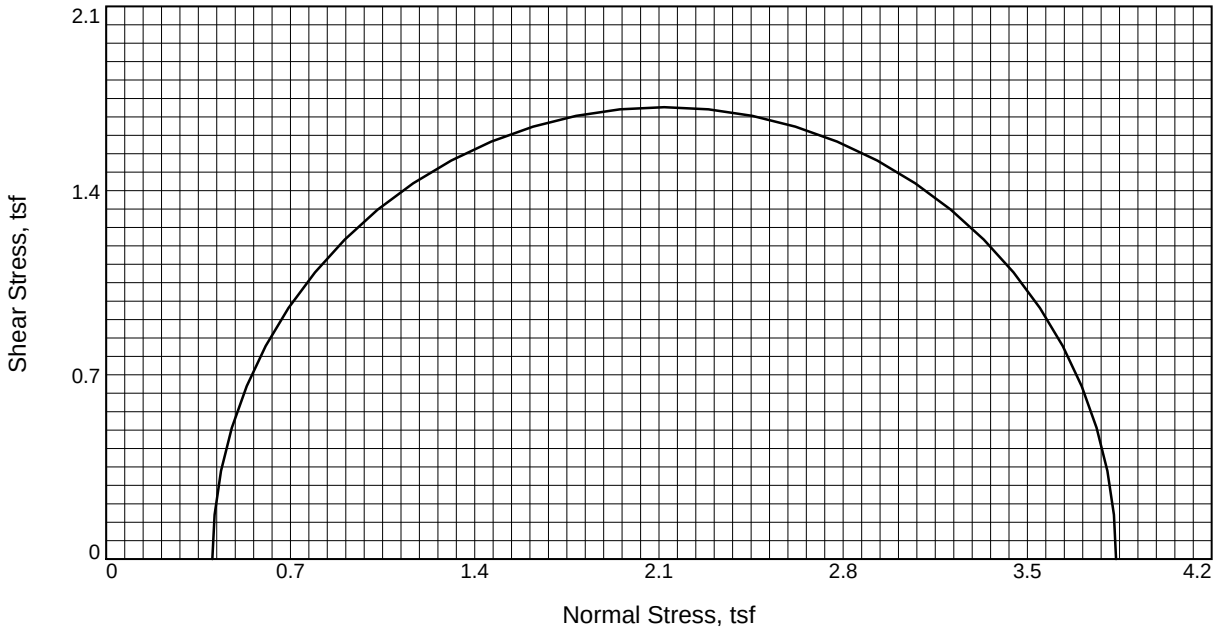
Sample Source	Sample Number	Start Depth (feet)	End Depth (feet)	Sample Distance (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	UC[5]		CBR Value[6]	Organic Content (%)
							LL	PL	PI		Dry Density (pcf)	Su (tsf)		
B-01	S-4	6.0	8.0	2.0	24.9	CH	60	20	40	95.6				
B-01	S-7	18.0	20.0	2.0	15.3	CL	35	16	19	79.0				
B-02	S-5	8.0	10.0	2.0	24.7	CH	60	20	40	90.0				
B-03	S-1	0.0	2.0	2.0	18.7	CH FILL	56	20	36	89.6				
B-03	S-3	4.0	6.0	2.0	22.4	CH	50	19	31	84.0				
B-03	S-4	6.0	8.0	2.0	24.0	CH					100.0	1.72		
B-04	S-1	0.0	2.0	2.0	17.9	CH FILL	52	19	33	89.2				
B-05	S-2	2.0	4.0	2.0	23.2	CH	61	21	40	94.5				
B-05	S-4	6.0	8.0	2.0	24.8	CH	66	21	45	93.5				
B-05	S-5	8.0	10.0	2.0	25.9	CH					98.2	1.37		
B-06	S-6	13.0	15.0	2.0	19.3	CL	47	18	29	79.0				
B-07	S-1	0.0	2.0	2.0	13.4	CL FILL	47	18	29	79.4				
B-07	S-2	2.0	4.0	2.0	25.5	CH	54	19	35	85.4				
B-07	S-6	13.0	15.0	2.0	22.3	CH					105.6	0.66		
P-01	S-1	0.0	2.0	2.0	17.5	CL FILL	47	18	29	77.7				
P-02	S-2	2.0	4.0	2.0	23.7	CH	58	20	38	84.9				
P-03	S-1	0.0	2.0	2.0	18.4	CL FILL	47	18	29	78.3				

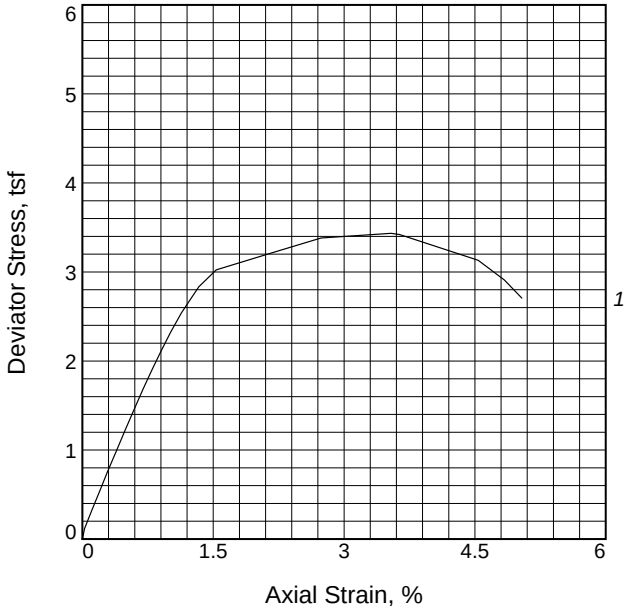
Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. ASTM D 2850, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ration, OC: Organic Content (ASTM D 2974)

Project No.: 43:3223
Project Name: Dashwood Trails Apartments
PM: Vincent Yin
PE: Richard E. Webb
Printed On: October 17, 2024

ECS Southwest, LLP - Houston
1000 North Post Oak Road, Suite 240
Houston, TX 77055
Phone: 713-955-1980
Fax: 281-520-4637





Sample No.		1
Initial	Water Content, %	24.0
	Dry Density, pcf	100.0
	Saturation, %	
	Void Ratio	0.6542
	Diameter, in.	2.76
	Height, in.	5.59
At Test	Water Content, %	0.0
	Dry Density, pcf	0.0
	Saturation, %	0.0
	Void Ratio	N/A
	Diameter, in.	2.76
	Height, in.	5.59
Strain rate, in./min.		0.028
Back Pressure, psi		0.00
Cell Pressure, psi		5.60
Fail. Stress, tsf		3.43
Ult. Stress, tsf		
σ_1 Failure, tsf		3.84
σ_3 Failure, tsf		0.40

Type of Test:
Unconsolidated Undrained

Sample Type: Shelby Tube

Description:

Assumed Specific Gravity= 2.65

Remarks:

Figure _____

Client: ECS

Project:

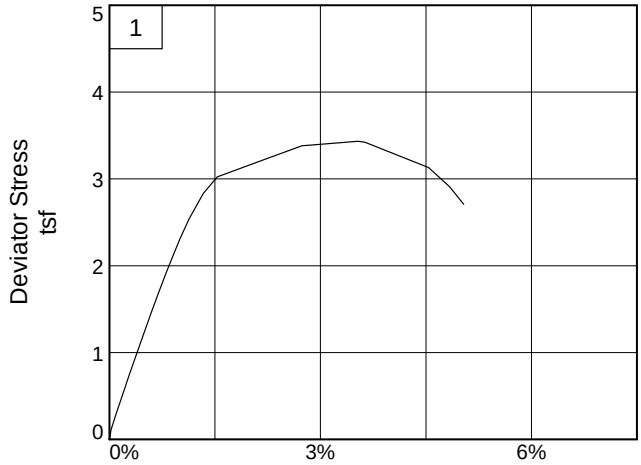
Source of Sample: B-3 **Depth:** 6'-8'

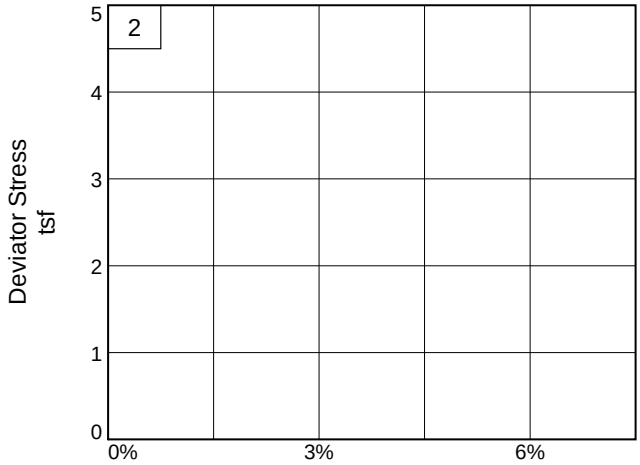
Sample Number: 4

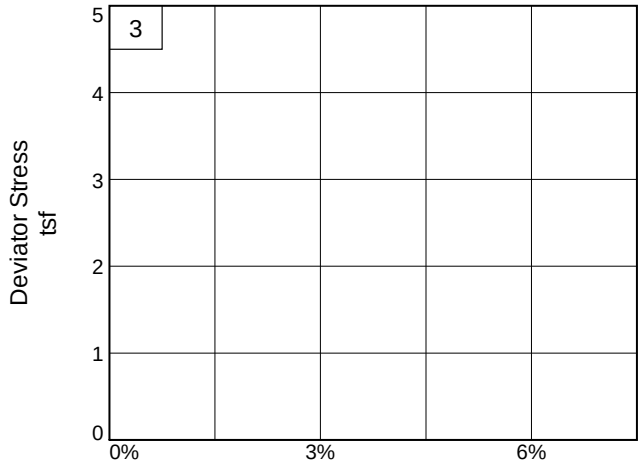
Proj. No.: KG24-027(3223) **Date Sampled:**

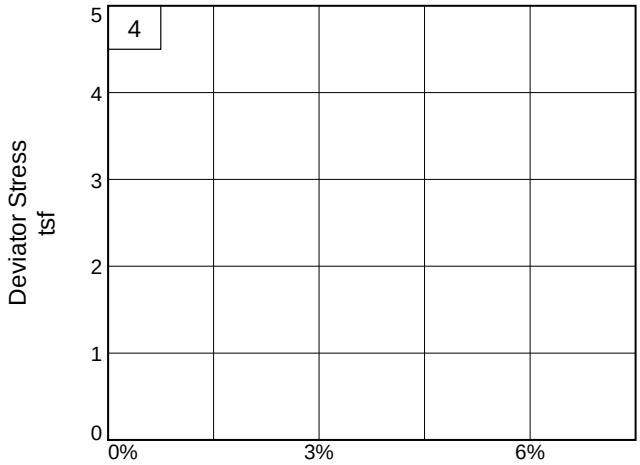
Kenallgeo

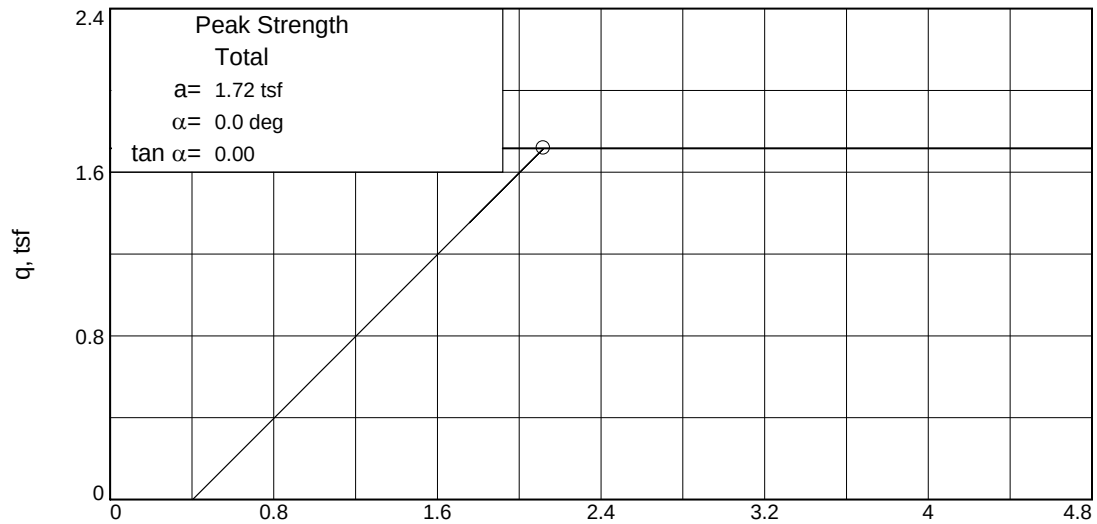
Tested By: FA **Checked By:** VC







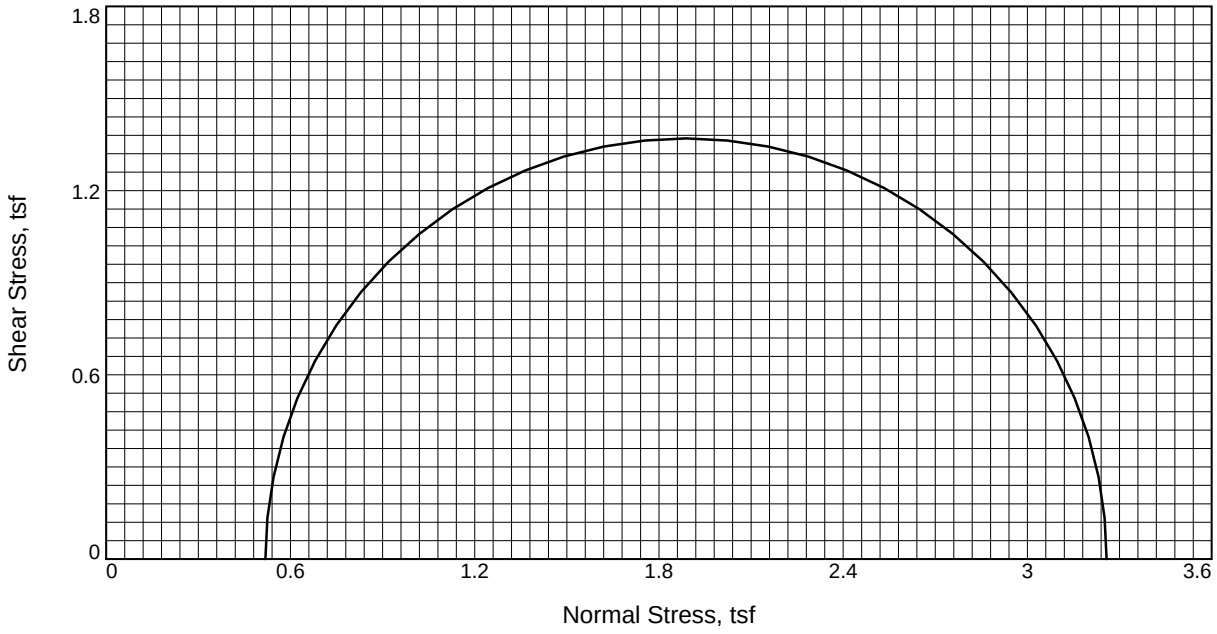


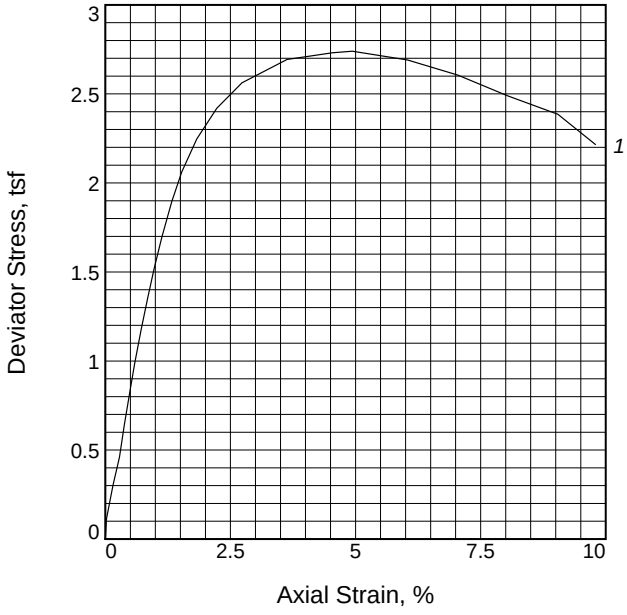


Stress Paths: o indicates peak

Client: ECS
Project:
Source of Sample: B-3 **Depth:** 6'-8' **Sample Number:** 4
Project No.: KG24-027(3223) **Figure** _____

Tested By: FA **Checked By:** VC





Sample No.		1
Initial	Water Content, %	25.9
	Dry Density, pcf	98.2
	Saturation, %	
	Void Ratio	0.6844
	Diameter, in.	2.77
	Height, in.	5.59
At Test	Water Content, %	0.0
	Dry Density, pcf	0.0
	Saturation, %	0.0
	Void Ratio	N/A
	Diameter, in.	2.77
	Height, in.	5.59
Strain rate, in./min.		0.028
Back Pressure, psi		0.00
Cell Pressure, psi		7.20
Fail. Stress, tsf		2.74
Ult. Stress, tsf		
σ_1 Failure, tsf		3.26
σ_3 Failure, tsf		0.52

Type of Test:
Unconsolidated Undrained

Sample Type: Shelbyn Tube

Description:

Assumed Specific Gravity= 2.65

Remarks:

Figure _____

Client: ECS

Project:

Source of Sample: B-5 **Depth:** 8'-10'

Sample Number: 5

Proj. No.: KG24-027(3223) **Date Sampled:**

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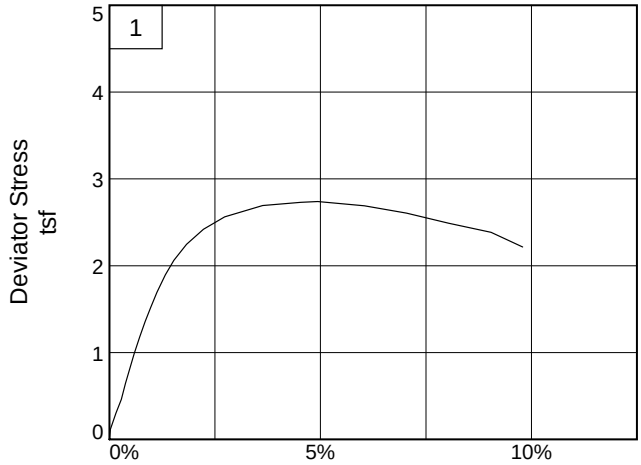
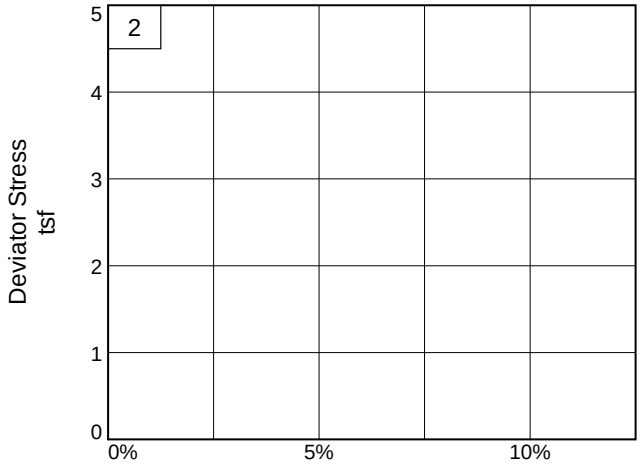
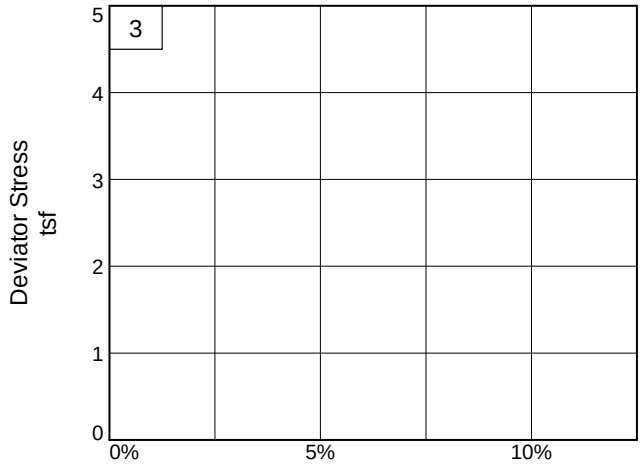
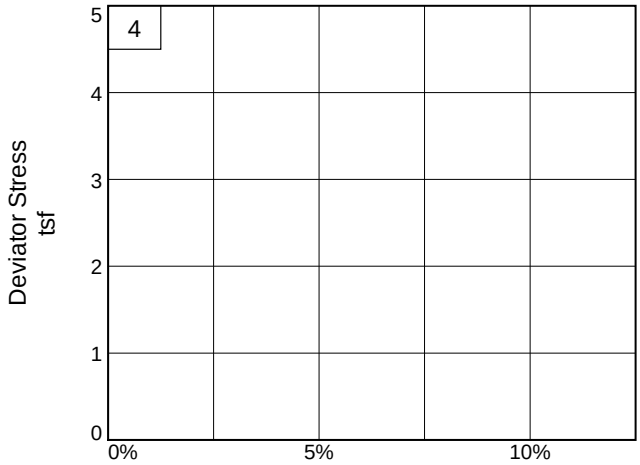
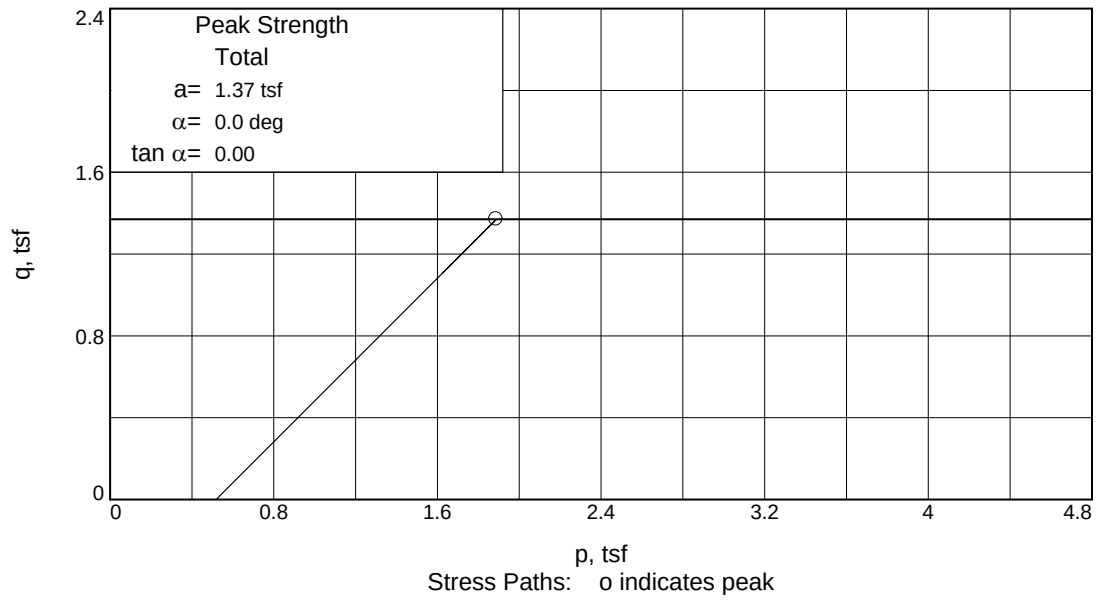
Tested By: FA **Checked By:** VC











Stress Paths: o indicates peak

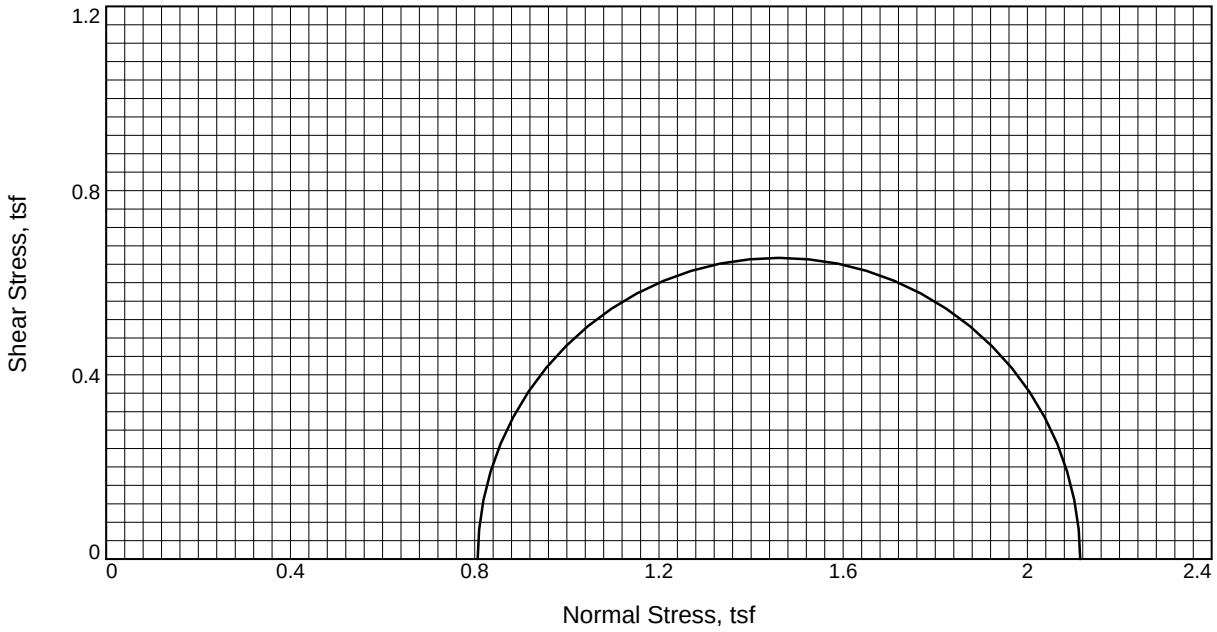
Client: ECS

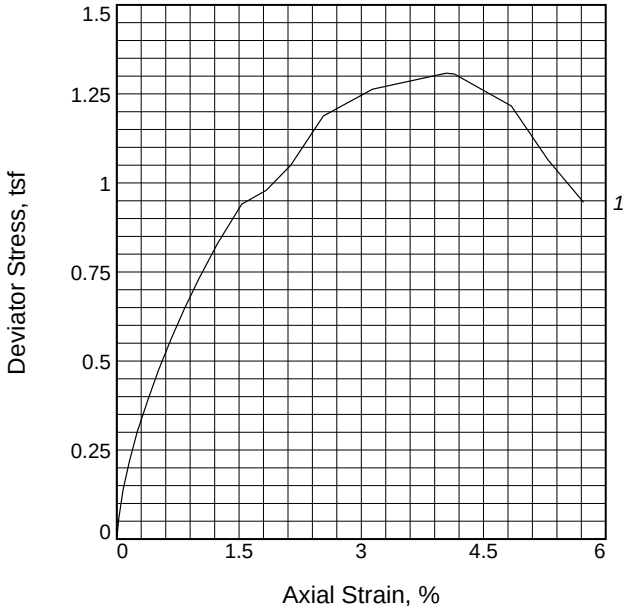
Project:

Source of Sample: B-5 **Depth:** 8'-10' **Sample Number:** 5

Project No.: KG24-027(3223) **Figure** _____

Tested By: FA **Checked By:** VC





Sample No.		1
Initial	Water Content, %	22.3
	Dry Density, pcf	105.6
	Saturation, %	
	Void Ratio	0.5669
	Diameter, in.	2.73
	Height, in.	5.58
At Test	Water Content, %	0.0
	Dry Density, pcf	0.0
	Saturation, %	0.0
	Void Ratio	N/A
	Diameter, in.	2.73
	Height, in.	5.58
Strain rate, in./min.		0.028
Back Pressure, psi		0.00
Cell Pressure, psi		11.20
Fail. Stress, tsf		1.31
Ult. Stress, tsf		
σ_1 Failure, tsf		2.11
σ_3 Failure, tsf		0.81

Type of Test:
Unconsolidated Undrained

Sample Type: Shelby Tube

Description:

Assumed Specific Gravity= 2.65

Remarks:

Figure _____

Client: ECS

Project:

Source of Sample: B-7 **Depth:** 13'-15'

Sample Number: 6

Proj. No.: KG24-027(3223) **Date Sampled:**

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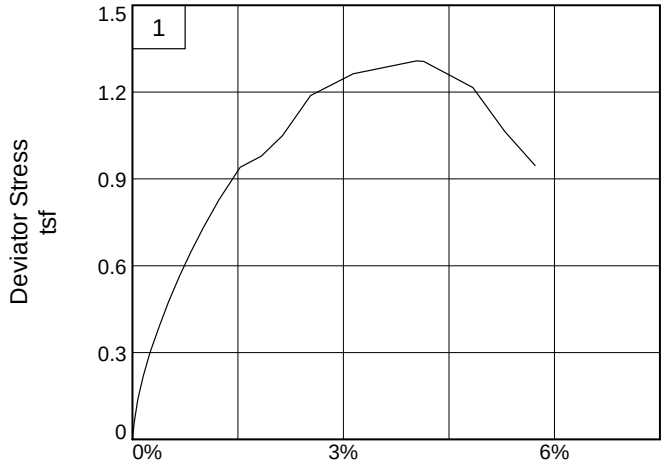
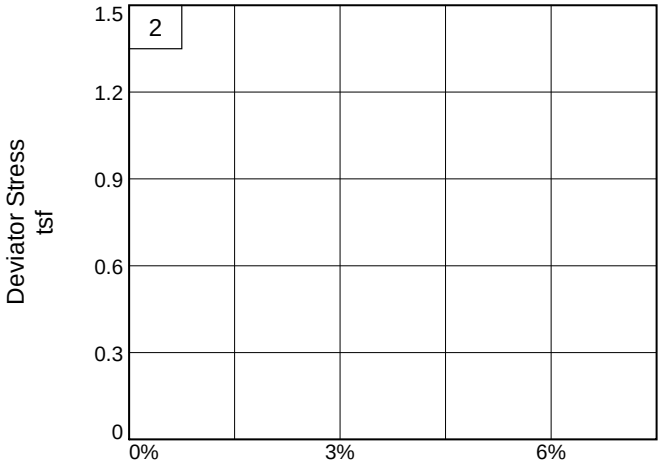
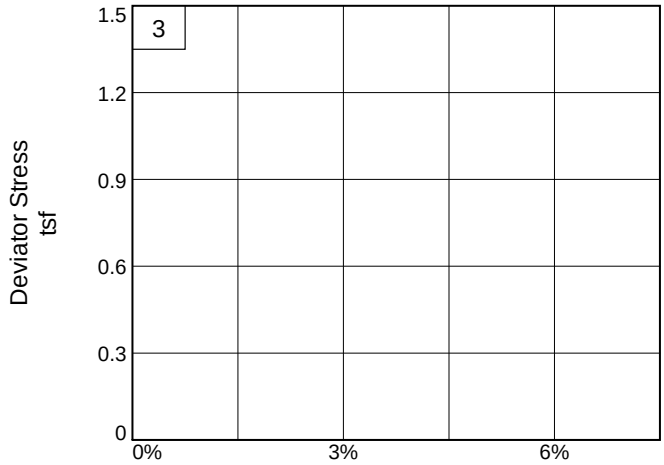
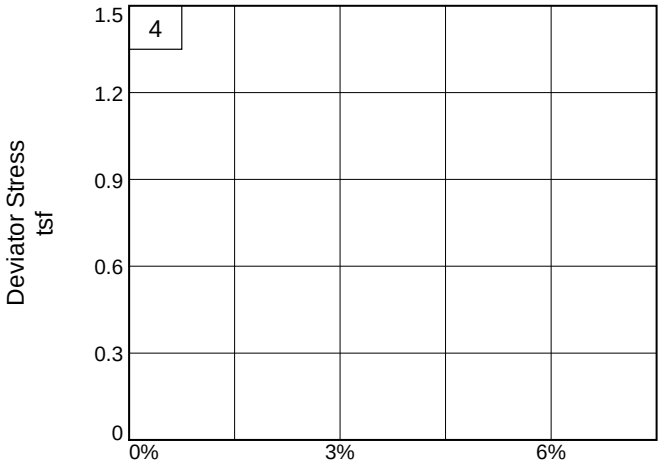
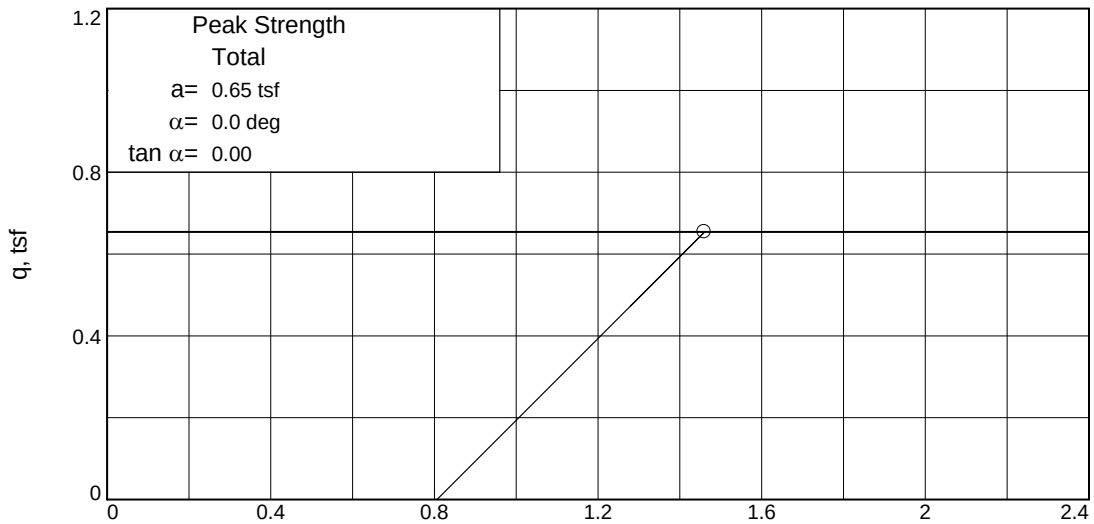
Tested By: FA **Checked By:** VC











Stress Paths: o indicates peak

Client: ECS
Project:
Source of Sample: B-7 **Depth:** 13'-15' **Sample Number:** 6
Project No.: KG24-027(3223) **Figure** _____

Tested By: FA **Checked By:** VC

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Paper Document submittal.

C. Electronic document submittal.

D. Preconstruction meeting.

E. Site mobilization meeting.

F. Progress meetings.

G. Submittals for review, information, and project closeout.

H. Requests for Interpretation (RFI) procedures.

I. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions of the Contract: Dates for applications for payment.

B. Section 01 00 00 - General Requirements: IECC Energy Efficiency test reports.

C. Section 01 35 64 - Sustainable Construction Requirements: Reporting related to sustainability certification project procedures.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with the requirements of this Section for coordination of execution of administrative tasks with timing of construction activities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DOCUMENT SUBMITTAL - GENERAL

A. Submittals shall be reviewed by the Architect within ten (10) business days from receipt and shall be returned to the Contractor for action or distribution.

1. All Submittals shall be reviewed and approved – by stamp and/or signature - by the Contractor prior to submission to the Architect. Submittals received by the Architect and not approved by the Contractor will be returned without review or processing.
2. Submittals that require review by the Architect’s or Owner's Consultants shall be forwarded to the Consultant upon receipt by the Architect. The Consultant shall then have ten (10) business days from receipt of submittal to review and return to the Architect, whereupon the Architect shall forward the reviewed submittal to the Contractor. The Contractor shall take into account the additional time associated with this process when scheduling.
3. Besides submittals for review, information, and closeout, this procedure applies to requests for information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.

3.02 PAPER DOCUMENT SUBMITTAL

A. Submit a minimum of five (5) copies of each submittal for the Architect’s review and use in distribution to the Owner. Where the submittal will require review by the Architect’s or Owner’s Consultants, submit seven (7) copies of each submittal. The Architect shall return a minimum of three (3) copies upon completion of review process.

3.03 ELECTRONIC DOCUMENT SUBMITTAL

A. All documents transmitted for purposes of administration of the contract may be in electronic (PDF) format and transmitted via e-mail.

B. All electronic Submittals shall be sent to the Architect from the Contractor – electronic submittals from sub-contractors will not be accepted.

C. All electronic submittals shall have the stamp and/or signature of approval by the Contractor indicating product or equipment submitted has been reviewed for compliance with Contract Documents.

D. All electronic submittals shall be in 8-1/2 x 11 inches (Letter) format. No other page/paper size submittals will be accepted.

E. Each electronic Submittal shall be no larger than 20 megabytes file size. Submittals with multiple PDF files that exceed this limit must be submitted in separate, smaller parts.

F. All electronic Submittals shall be reviewed and returned in (PDF) format; no hard copies shall be provided. The General Contractor shall be responsible for any necessary reproduction and distribution of the reviewed electronic submittal to his sub-contractors.

G. Electronic document requirements do not apply to samples or color selection charts.

H. The Architect is not responsible for any delays in the review process due to:
   1. Misdirected or lost emails.
   2. Corrupted files, or files that otherwise, can not be opened.
   3. Non-legible or incomplete scans.
   4. Technical issues or difficulties with email servers outside of the Architect's office.
   5. Technical issues, difficulties, or outages of the Internet that occur outside of the Architect's office.

3.04 PRECONSTRUCTION MEETING

A. Architect or Texas Department of Housing and Community Affairs (TDHCA) shall schedule a meeting prior to start of construction.

B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. TDHCA Representative.
   5. Special consultants.
   6. Contractor's superintendent.
   7. Major subcontractors.

C. Agenda:
   1. Use of premises by Owner and Contractor.
   2. Owner's requirements and partial occupancy prior to completion.
   3. Review of list of Subcontractors, list of Products, schedule of values, and progress schedule.
   4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   5. Survey and building layout.
   6. Security and housekeeping procedures.
   7. Schedules.
   8. Application for payment procedures.
   9. Procedures for testing.
   10. Procedures for maintaining record documents.

D. Record minutes and distribute copies within five business days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.05 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum monthly intervals.

B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.

4. TDHCA Representative.
5. Contractor's superintendent.
6. Major subcontractors.

C. Agenda:
1. Review of work progress.
2. Field observations, problems, and decisions.
3. Identification of problems that impede, or will impede, planned progress.
4. Review of submittals schedule and status of submittals.
5. Maintenance of progress schedule.
6. Corrective measures to regain projected schedules.
7. Planned progress during succeeding work period.
8. Maintenance of quality and work standards.
9. Effect of proposed changes on progress schedule and coordination.
10. Other business relating to work.

D. Record minutes and distribute copies within five working days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.06 REQUESTS FOR INTERPRETATION (RFI)

A. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
b. Do not forward requests which solely require internal coordination between subcontractors.

C. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.

D. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

E. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.

F. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

3.07 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
1. Product data.
2. Shop drawings.
3. Samples for selection.
4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below .

3.08 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
1. Design data.
2. Sustainability design submittals and reports.

3. Certificates.
4. Test reports.
5. Inspection reports.
6. Manufacturer's instructions.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.09 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Energy Audit Report when required.

B. Submit Correction Punch List for Substantial Completion.

C. Submit Final Correction Punch List for Substantial Completion.

D. When the following are specified in individual sections, submit them at project closeout:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

E. Submit for Owner's benefit during and after project completion.

3.10 SUBMITTAL PROCEDURES

A. General Requirements:
1. Use a separate transmittal for each item.
2. Transmit using approved form.
3. Sequentially identify each item. For revised submittals use original number and a sequential alphabetical suffix.
4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
    a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
6. Schedule submittals to expedite the Project, and coordinate submission of related items.
7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
8. Provide space for Contractor and Architect review stamps.
9. When revised for resubmission, identify all changes made since previous submission.
10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
12. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:

1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.11 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and accept, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt, but will take no other action.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
   1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
   1. Authorizing purchasing, fabrication, delivery, and installation:
      a. "No Exceptions Taken", or language with same legal meaning.
      b. "Exceptions Noted", or language with same legal meaning.
         1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
   2. Not Authorizing fabrication, delivery, and installation:
      a. "Revise and Resubmit".
         1) Resubmit revised item, with review notations acknowledged and incorporated.
      b. "Rejected".
         1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
   1. Items for which no action was taken:
      a. "No Action Taken" - to notify the Contractor that the submittal has been received for record only.

END OF SECTION

SECTION 01 61 16

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

1.03 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings applied on site.
   2. Interior adhesives and sealants applied on site, including flooring adhesives.
   3. Flooring.
   4. Composite wood.
   5. Products making up wall and ceiling assemblies.
   6. Thermal and acoustical insulation.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
   1. Exterior and interior paints and coatings applied on site;.
   2. Exterior and interior adhesives and sealants applied on site, including flooring adhesives.
   3. Wet-applied roofing and waterproofing.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
   1. Concrete.
   2. Clay brick.
   3. Metals that are plated, anodized, or powder-coated.
   4. Glass.
   5. Ceramics.
   6. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.

D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board; current edition.

E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.

F. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.

G. CRI (GLP) - Green Label Plus Testing Program - Certified Products; www.carpet-rug.org; current edition.

H. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; current edition.

I. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

J. SCS (CPD) - SCS Certified Products; current listings at www.scscertified.com.

K. UL (GGG) - GREENGUARD Gold Certified Products; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

1.05 SUBMITTALS

A. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

B. Sustainable Design Reporting: Submit evidence of compliance.

C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.06 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using New Single-Family Residence exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
   1. Wet-Applied Products: State amount applied in mass per surface area.
   2. Paints and Coatings: Test tinted products, not just tinting bases.
   3. Evidence of Compliance: Acceptable types of evidence are the following;
      a. Current UL (GGG) certification.
      b. Current SCS (CPD) Floorscore certification.
      c. Current SCS (CPD) Indoor Advantage Gold certification.
      d. Current listing in CHPS (HPPD) as a low-emitting product.
      e. Current CRI (GLP) certification.
      f. Test report showing compliance and stating exposure scenario used.
   4. Product data submittal showing VOC content is NOT acceptable evidence.
   5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.
      b. Certification by manufacturer that product complies with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.
      b. Report of laboratory testing performed in accordance with requirements.
      c. Published product data showing compliance with requirements.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Products: Comply with the most stringent of Federal, State, and Local requirements, or these specifications.

B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:

1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
2. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
2. Joint Sealants: SCAQMD 1168 Rule.
3. Paints and Coatings: Each color; most stringent of the following:
a. 40 CFR 59, Subpart D.
b. SCAQMD 1113 Rule.
c. CARB (SCM).
4. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Sections:

1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

A. Material certificates.

B. Material test reports.

C. Floor surface flatness and levelness measurements.

1.4 QUALITY ASSURANCE

A. 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."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

D. Concrete Testing Service: Owner engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

PART 2 - PRODUCTS

2.1 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.

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.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

D. 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.

2.3 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 I/II, gray. Supplement with the following:

a. Fly Ash: ASTM C 618, Class F or C.

b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, graded.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2. Retarding Admixture: ASTM C 494/C 494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.7 CURING MATERIALS

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

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 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.

2.9 CONCRETE MIXTURES

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.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 20 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability.

D. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As required by prints at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.50 – footings; 0.45 – all other mixes

3. Slump Limit: 4 inches (125 mm) or 8 inches (200 mm for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).

4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

5. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

a. Add water vapor reducing admixture per manufacturers specified dosage rate to ready mix truck at the batch plant, or jobsite before discharge, mix rapidly for 7 minutes. (Follow Manufacturer’s Instructions).

2.10 FABRICATING REINFORCEMENT

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

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), 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. Chamfer exterior corners and edges of permanently exposed concrete.

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.

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.4 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.

3.5 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.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) 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.

E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.6 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. 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. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: 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.

C. 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.

3.8 FINISHING FLOORS AND SLABS

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

B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm) at the gymnasium floor and 1/4" (6.4mm) at all other locations.

3.9 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 (1 kg/sq. m 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. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. **Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.**

4. **Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.**

3.10 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.**

3.11 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.**

END OF SECTION 033000

SECTION 03 35 11

CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Curing Compounds.

B. Clear penetrating sealers.

PART 2 PRODUCTS

2.01 COATINGS

A. Curing and Sealing Compound, Moisture Emission-Reducing, Membrane-Forming: Liquid, membrane-forming, clear sealer, for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
   1. Use this product to cure and seal all slabs to receive adhesively applied flooring.
   2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
   3. VOC Content: Less than 100 g/L.
   4. Solids Content: 25 percent, minimum.
   5. Manufacturers:
      a. Master Builders Solutions; MasterKure CC 160 WB (formerly Kure-N-Seal): www.master-builders-solutions.com
      b. Or approved equal.

B. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
   1. Application: Use at exposed slabs and toppings not scheduled to receive finish flooring.
   2. Vehicle: Water-based.
   3. VOC Content: OTC compliant.
   4. Manufacturers:
      a. Dayton Superior Corporation; Cure & Seal 1315 EF: www.daytonsuperior.com.
      b. Euclid Chemical Company; DIAMOND CLEAR VOX: www.euclidchemical.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

END OF SECTION

SECTION 03 52 10

LIGHTWEIGHT CONCRETE FLOOR FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lightweight concrete fill over structural floor deck (Balconies).

1.02 REFERENCE STANDARDS

A. ASTM C138/C138M - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete; 2016a.

B. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

C. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

D. ASTM C495/C495M - Standard Test Method for Compressive Strength of Lightweight Insulating Concrete; 2012.

E. ASTM E1993/E1993M - Standard Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs; 1998 (Reapproved 2013).

F. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2013).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide physical characteristics, thermal values, product limitations and product compatibility with floor coverings.

C. Manufacturer's Installation Instructions: Indicate mix instructions.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer .

1.05 FIELD CONDITIONS

A. Do not place insulating concrete mix at ambient temperatures lower than 40 degrees F without heating mix water to 90 to 110 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Lightweight Insulating Concrete:
   1. Elastizell Corp. of America: www.elastizell.com.
   2. Or approved equal.

2.02 MATERIALS

A. Cement: ASTM C150/C150M, Portland Type I - Normal, gray color.

B. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

C. Sand: ASTM C33: Washed and graded.

D. Aggregates: ASTM C332: 3/8 inch or smaller pea gravel, or lightweight aggregates may be used.

E. Admixtures: Admixtures for water reducing, or accelerating cure may be used in accordance with manufacturer's recommendations where required for unusual project conditions.

F. Reinforcement: 1/2 inch polyester fibers with a tensile strength greater than 130ksi or as recommended by by manufacturer.

2.03 CONCRETE MIX

A. Test for compressive strength in accordance with ASTM C495/C495M, for wet density in accordance with ASTM C138/C138M, and for dry density after oven drying.

B. Provide concrete mix with the following minimum properties:

1. Cast Density: 34 to 42 pounds per cubic foot.
2. Compressive Strength: 160 pounds per square inch

2.04 ACCESSORIES

A. Reinforcement:
   1. Hexagonal woven wire mesh; galvanized, sizes as recommended by manufacturer.

B. Underslab Waterproofing and Vapor Retarder: Semi-rigid bituminous membrane, seven-ply, complying with ASTM E1993/E1993M.
   1. Composition: Weather-resistant coated, permanently bonded bituminous core board composed of an inner core, suspended and sealed within high melt point asphalt-impregnated felt, with glass mat liner and polyethylene anti-stick sheet.
   2. Permeance: 0.002 perms, maximum.
   3. Tensile Strength: 140 pounds-force/inch, minimum.
   4. Puncture Resistance: 90 pounds-force, minimum, when tested in accordance with ASTM E154/E154M.
   5. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   6. Products:
      a. W. R. Meadows, Inc; PRECON-Blindside/Underslab Membrane: www.wrmeadows.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

B. Notify Architect immediately of conditions that would prevent correct and timely installation.

C. Do not proceed with work until detrimental conditions have been corrected.

3.02 PREPARATION

A. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

B. Vacuum clean surfaces.

C. Prime and waterproof substrate in accordance with rubberized asphalt membrane manufacturer's instructions.

D. Close floor openings.

3.03 INSTALLATION

A. Lightweight concrete shall be pumped or otherwise transported to the place of final deposition in accordance with manufacturer's approved methods.
   1. Pumping height shall not adversely affect material.

B. Field density shall be checked periodically during placement of material.
   1. Variations greater than +/- 4 pcf between the recommended density and the density at point of discharge will require a modification be made to the mix.

C. Finishing: Lightweight concrete shall be screeded from 2-1/2 inches at building face to a nominal thichness of 2 inches at outside edge of deck for drainage.
   1. Hand steel trowel and broom finish with tooled joints every 8 linear feet.

D. Slope concrete for surface drainage as indicated.

3.04 CURING

A. Prohibit load and foot traffic for a minimum of 24 hours from time of initial set, or longer if applicator determines project or weather conditions require.
   1. Floor should not be loaded for a minimum of one week (7 days), then when loaded, loads should be distributed and not concentrated.

B. Cure in accordance with lightweight aggregate manufacturer's instructions.

END OF SECTION

SECTION 03 54 00

CAST UNDERLAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Liquid-applied self-leveling floor underlayment.
   1. Use gypsum-based type at all interior locations where indicated on the drawings.
      a. For all UL Design fire-rated assemblies shown/referenced on the drawings, provide conforming gypsum-based underlayment material.

1.02 REFERENCE STANDARDS

A. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 1999 (Reapproved 2014).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.

C. Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Instructions.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturerusing manufacturer approved mixing and pumping equipment.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F.

1.06 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F 24 hours before, during and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gypsum Underlayment:
   1. ARDEX Engineered Cements; ARDEX K15: www.ardexamericas.com.
   2. Hacker Industries, Inc; FirmFill 2010: www.hackerindustries.com.
   3. Maxxon Corporation; Gyp-Crete 2000/3.2K: www.maxxon.com.
   4. USG; Levelrock® Series 2500 Floor Underlayment: www.usg.com.

2.02 MATERIALS

A. Cast Underlayments, General:
   1. Comply with applicable code for combustibility or flame spread requirements.

B. Gypsum-Based Underlayment: Gypsum based mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
   1. Compressive Strength: Minimum 3,000 pounds per square inch, tested per ASTM C472.

2. Density: Maximum 120 pounds per cubic foot.
3. Surface Burning Characteristics: Flame spread/Smoke developed/Fuel Contribution index of 0/0/0 in accordance with ASTM E84.
4. Material shall not contain any source of nutrients to sustain mold growth.

C. Aggregate: Dry, well graded, washed silica aggregate, approximately 1/8 inch in size and acceptable to underlayment manufacturer.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

E. Primer: Manufacturer's recommended type.

F. Joint and Crack Filler: Latex-based filler, as recommended by manufacturer.

2.03 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Add aggregate for areas where thickness will exceed 1-1/2 inch. Mix underlayment and water for at least two minutes before adding aggregate, and continue mixing to assure that aggregate has been thoroughly coated.

C. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.02 PREPARATION

A. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

B. Vacuum clean surfaces.

C. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

D. Close floor openings.

E. Expansion Joints: Allow expansion joints to continue through cast underlayment at same width as joint.

3.03 APPLICATION

A. Scheduling: Application of cast underlayment shall not occur until building is enclosed; including roof, windows, doors, and other fenestration.
1. Install cast underlayment after drywall installation unless tenant finish requirements identify partitioning after the pour.

B. Install underlayment in accordance with manufacturer's instructions.

C. Pump or pour material onto substrate. Do not retemper or add water.
1. Pump, move, and screed while the material is still highly flowable.
2. Be careful not to create cold joints, except where authorized.
3. Except at authorized cold joints, place as continuously as possible until application is complete.

D. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft.

3.04 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.
1. Ventilation and adequate heat shall be provided continuously to rapidly remove moisture from the area until the cast underlayment is dry.
a. Confirm with manufacturer on recommended drying time requirements.
b. Test for dryness in accordance with manufacturer's instructions prior to conducting further work in area.

3.05 PROTECTION

A. Place temporary wood planking over cast underlayment wherever it will be subjected to heavy wheeled, or concentrated loads.
   1. Refer to manufacturer's recommendations for additional requirements for protection prior to finish floor installation.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block for monument sign and trash enclosures.

B. Mortar and grout.

C. Reinforcement and anchorage.

D. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).

C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016.

F. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

G. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

H. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

I. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

K. ASTM C476 - Standard Specification for Grout for Masonry; 2016.

L. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

M. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2016.

N. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2005.

O. BIA Technical Notes No. 18A - Accommodating Expansion of Brickwork; 2006.

P. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.

Q. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2005.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units and masonry accessories.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials such as mud, grease, or other debris.

1. Concrete Masonry Units: Store cubes in single stacks on level ground, covered and protected from inclement weather.

2. Protect bagged materials and brick siding units from rain and groundwater by covering and storing on pallets or other means.
3. Carefully stack and store all flashings and metal trim to prevent creasing, twisting, or other damage.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for end return blocks and other detailed conditions.
   3. Load-Bearing Units: ASTM C90, medium weight.
      a. Exposed Faces: Manufacturer's standard color and texture where indicated.

2.02 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C404.

E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

F. Water: Clean and potable.

G. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Type N.
   2. Color: Standard gray.

H. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.

2.03 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.

B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

C. Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss.
   2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3.
   3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

2.04 ACCESSORIES

A. Preformed Control Joints: Neoprene material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width; self expanding, by maximum lengths available

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
   1. Manufacturers:
      a. PROSOCO Inc.; SureKlean No. 600: www.prosoco.com
      b. Dietrich Tecnologies Inc.; 202 New Masonry Detergent: www.dietrichtechnologies.com.

c. Cleans It All Global Inc; Envirosafe Mansonry Cleaner: www.cleansitall.com.

D. Penetrating Water Repellent: Penetrating, water-based silicone water repellent for concrete and masonry.
   1. Manufacturers:
      a. PROSOCO Inc.; Sure Klean Weather Seal Siloxane: www.prosoco.com
      b. Applied Technologies; A-Tech Masonry and Brick Sealer: www.appliedtechnologies.com.
      c. Pecora Corp.; KlereSeal 910-W/920-W: www.pecora.com.

2.05 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Exterior, non-loadbearing masonry: Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

D. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

E. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches, vertical dimension typical.
   3. Mortar Joints: 3/8 inch Concave/Rodded.

D. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: 3/8 inch Concave/Rodded.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Horizontal surfaces exposed to weather: Where water may collect on ledges, caps, or other horizontal surfaces, uniformly slope top surface to provide positive drainage.

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 24 inches on center.

B. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

3.07 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

1. Wall ties shall extend into the veneer a minimum of 1-1/2 inches, with not less than 5/8 inch mortar or grout cover to outside face.

3.08 REINFORCEMENT AND ANCHORAGES - MULTIPLE WYTHE UNIT MASONRY

A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties spaced as indicated on drawings.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.09 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 4 inches, minimum, to form watertight pan at nonmasonry construction.
2. Remove or cover protrusions or sharp edges that could puncture flashings.
3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend plastic, laminated, and EPDM flashings to within 1/4 inch of exterior face of masonry.

C. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

D. Install flashing to dry surfaces at air and surface temperatures 25° F and above in accordance with manufacturer's written installation instructions at locations indicated on the Drawings.

E. Precut pieces of flashing to easily handled lengths for each location.

1. Remove silicone-coated release paper and position flashing carefully before placing in against the surface.
2. When properly positioned, place against surface by pressing firmly into place by hand roller. Fully adhere flashing to substrate to prevent water from migrating under flashing.
3. Overlap adjacent pieces 2 inches and roll all seams with a steel hand roller.

4. Trim bottom edge 1/2 inch back from exposed face of the wall. Flashing shall not be permanently exposed to sunlight.
5. At heads, sills and all flashing terminations turn up ends a minimum of 2 inches and make careful folds to form an end dam, with seams sealed, or use pre-formed end dams, with seams sealed.
6. Apply a bead or trowel coat of mastic along flashing top edge, seams, cuts and penetrations.

F. Do not expose flashing membrane to sunlight for more than thirty days prior to enclosure.

G. When required by dusty or dirty site conditions or by surfaces having irregular or rough texture, apply surface conditioner by spray, brush or roller at the rate recommended by manufacturer, prior to flashing installation.
1. Allow surface to dry completely before flashing installation.

3.10 LINTELS

A. Install loose steel lintels over masonry openings where indicated on the drawings.

B. Maintain minimum 8 inch bearing on each side of opening.

3.11 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

3.12 CONTROL AND EXPANSION JOINTS

A. Comply with the provisions of BIA Technical Notes No. 18A except where exceeded by the requirements of the Contract Documents.

B. Vertical expansion joints shall be located/installed as shown on the Drawings and/or in accordance with the following:
1. For brickwork without openings, space expansion joints no more than 25 feet o.c.
2. For brickwork with multiple openings (doors, windows, etc.) consider symmetrical placement of expansion joints and spacing of expansion joints no more than 20 feet o.c.
3. Expansion joints shall be located/installed:
   a. At or near corners.
   b. At offsets or setbacks.
   c. At wall intersections.
   d. At changes in wall height.

C. Horizontal expansion joints shall be located immediately below shelf angles. A minimum of 1/4 inch space for compressible material is required below shelf angle.

D. Do not continue horizontal joint reinforcement through control or expansion joints.

E. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

F. Form expansion joint as detailed on the Drawings, or in accordance with BIA Technical Notes No. 18A.

G. Uniformly install rod at level recommended by sealant manufacturer (minimum – depth of joint after backer rod is installed is one half the width).

3.13 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Mortar Joint Thickness: 1/8 inch in 3 ft.

3.14 CUTTING AND FITTING

A. Cut and fit for pipes, conduit, and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

C. Seal all anular spaces of pipes, conduit, and sleeves penetrating masonry surfaces.

3.15 CLEANING - GENERAL

A. Clean work upon completion of each days work.

B. Remove excess mortar, droppings, and mortar smears.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Keep walls clean daily during installation using brushes as harsh cleaning methods after walls have been erected may mar the surface of the masonry.
   1. Do not allow excess mortar lumps or smears to harden on the finished surfaces.

F. Use non-metallic tools in cleaning operations.

3.16 PROTECTION

A. A. Protect finished Work from damage from construction activities.
   1. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

3.17 CLEANING - FINAL

A. Clean the completed walls with masonry cleaner, strictly following the manufacturer's instructions including thorough rinsing.

B. Do not use acid or abrasives for general cleaning of the finished surfaces.
   1. ONLY for stubborn mortar stains or smears, a 15:1 solution of water and a concentrated, general-purpose acidic cleaner may be used as long as the walls are thoroughly wetted before applying the cleaning solution and thoroughly rinsed with clean water immediately after washing.

C. Failure to strictly follow these and manufacturer's instructions that results in permanent damage to the finished face and requires repair and/or replacement of material will be the responsibility of and at the cost of the Contractor.

END OF SECTION

SECTION 04 72 00

CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural cast stone at monument sign.

B. Units required are indicated on drawings as "precast concrete".

C. Units required are:
   1. Exterior wall units, including wall caps and coping.

1.02 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2009 (Reapproved 2015).

D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016.

G. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2016.

J. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2016.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
   2. Current producer member of the Cast Stone Institute or the Architectural Precast Association.
   3. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.

D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

F. Store mortar materials where contamination can be avoided.

G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Cast Stone:

1. Any current producer member of the Cast Stone Institute.

2.02 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
   1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
   2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
   3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
   4. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
   1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI CODE-318.
   1. Pieces More than 24 inches in Any Dimension: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.

2.03 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Admixtures: ASTM C494/C494M.

E. Water: Potable.

F. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi), deformed bars, galvanized.
   1. Galvanized in accordance with ASTM A767/A767M, Class I.

G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

I. Mortar: Portland cement-lime, as specified in Section 04 05 11; do not use masonry cement.

J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 20 00.

C. Mechanically anchor each cast stone unit.

D. Setting:
   1. Drench cast stone components with clear, running water immediately before installation.
   2. Set units in a full bed of mortar unless otherwise indicated.
   3. Fill vertical joints with mortar.

4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.02 TOLERANCES

A. Joints: Make all joints 3/8 inch, except as otherwise detailed.
   1. Rake mortar joints 3/4 inch for pointing.
   2. Remove excess mortar from face of stone before pointing joints.
   3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
   4. Leave the following joints open for sealant:
      a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
      b. Joints in projecting units.
      c. Joints between rigidly anchored units, including soffits, panels, and column covers.
      d. Joints below lugged sills and stair treads.
      e. Joints below ledge and relieving angles.
      f. Joints labeled "expansion joint".

B. Installation Tolerances:
   1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
   2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.
   3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
   4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.03 REPAIR

A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.
   1. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.
   2. Repair methods and results subject to Architect 's approval.

3.04 CLEANING

A. Keep cast stone components clean as work progresses.

END OF SECTION

SECTION 04 73 00

MANUFACTURED STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured stone masonry veneer.

B. Installation materials.

C. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

B. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring; 2003 (Reapproved 2013).

C. ASTM C847 - Standard Specification for Metal Lath; 2014a.

D. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2016b.

E. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2016c.

F. ASTM C1670/C1670M - Standard Specification for Adhered Manufactured Stone Masonry Veneer Units; 2017.

G. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2016.

H. ASTM C1780 - Standard Practice for Installation Methods for Adhered Manufactured Stone Masonry Veneer; 2017.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

J. ICC-ES AC51 - Acceptance Criteria for Precast Stone Veneer; 2016.

K. NCMA (AMSV) - Installation Guide and Detailing Options for Compliance with ASTM C1780 for Adhered Manufactured Stone Veneer; Current Edition, Including All Revisions.

L. NCMA TEK 20-01 - Key Installation Checkpoints for Manufactured Stone Veneer; 2014.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for manufactured stone masonry units, mortar, lath, and rainscreen drainage material, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Submit detail drawings depicting proper installation and flashing techniques. Coordinate locations with those found on drawings.

D. Manufacturer's Certificate: Certify that manufactured stone units and mortar meet or exceed specified requirements.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum ten years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Prevent mechanical damage and contamination by other materials.

C. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.

1.06 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

1.07 WARRANTY

A. Provide 50 year manufacturer warranty for manufactured stone units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Adhered Manufactured Stone Masonry Veneer (AMSMV):
   1. Coronado Stone Products; Ledgestone Series: www.coronado.com.
   2. Cultured Stone; Country Ledgestone Series: www.culturedstone.com.
   3. Dutch Quality Stone; Stack Ledge Series: www.dutchqualitystone.com.
   4. Eldorado Stone; Cliffstone Series: www.eldoradostone.com.
   5. StoneWorks; Southern Ledgestone Series: www.estoneworks.com.
   6. StoneCraft Industries: www.stonecraft.com.

2.02 MANUFACTURED STONE MASONRY VENEER

A. Manufactured Stone Masonry: Cast masonry units using a mixture of cement, lightweight aggregates, concrete additives and color pigments to replicate appearance of natural stone and designed to be applied with a cementitious mortar to a backing surface, complying with ASTM C1670/C1670M and ICC-ES AC51.
   1. Style: Ledgestone style as selected by Owner.
   2. Color, Texture, Range, Special Shapes: As selected.
   3. Walls: Provide with blended color/texture:
      a. Percent 60, Color: #1.
      b. Percent 40, Color: #2.

B. Trim: Provide wall caps, drip ledges, and corner stones.

2.03 MORTAR APPLICATIONS

A. Use only factory premixed packaged dry materials for mortar, with addition of water only at project site.
   1. Exception: If a specified mix design is not available in a premixed dry package, provide equivalent mix design using standard non-premixed materials.

B. Mortar Color: Natural gray unless otherwise indicated.

C. Scratch Coat Mortars: Scratch coat mortars for application directly to metal lath.
   1. Prepackaged/Preblended: ASTM C1714/C1714M, Type N or Type S.

D. Setting Bed Mortars: Setting bed used to adhere manufactured stone veneer units to scratch coat mortar or to bondable concrete or concrete masonry.
   1. Prepackaged/Preblended: ASTM C1714/C1714M, Type S.

2.04 MORTAR MIXES

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with addition of water only.
   1. Color: Standard gray.

2.05 ACCESSORIES

A. Metal Lath with Rainscreen Drainage Material: Factory-assembled combination of mesh drainage material and metal lath.
   1. Diamond Mesh Metal Lath: ASTM C847, galvanized, self-furring.
      a. Weight: To suit application and as specified in ASTM C841 for framing spacing.
   2. Rainscreen Drainage Mesh: 90 percent open non-woven polyester mesh.

a. Thickness: 1/4 inch.
b. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.

B. Water-Resistive Air Barrier: See Section 07 25 00.

C. Flashings: See Section 04 20 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that backup wall system construction complies with AMSMV manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51.

B. Verify that substrates to receive mortar scratch coat or setting bed comply with AMSMV manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51:
1. Concrete Masonry: Verify joints are cut flush and surface is ready to receive mortar setting bed. Verify no bituminous or water repellent coatings exist on masonry surface.
2. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.

C. Verify that related items provided under other sections are properly sized and located.

D. Verify that built-in items are in proper location, and ready for installation of AMSMV.

3.02 PREPARATION

A. Dampen masonry surfaces to reduce excessive suction.

3.03 INSTALLATION - WATER-RESISTIVE BARRIER

A. Where required by manufactured stone units manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 or ICC-ES AC51, install 2 layers of water-resistive barrier in accordance with water-resistive barrier manufacturer's instructions. Integrate water-resistive barrier with all flashing accessories, adjacent water-resistive barriers, doors, windows, penetrations, and cladding transitions.

B. Apply water-resistive barrier horizontally with upper layer lapped over lower layer minimum 2 inches.

C. Lap water-resistive barrier minimum 6 inches at vertical joints.

D. Lap water-resistive barrier minimum 16 inches past the corner in both directions at inside and outside corners.

3.04 INSTALLATION - RAINSCREEN DRAINAGE MATERIAL

A. Install rainscreen drainage material and metal lath with accessories over sheathing material and water-resistive barrier with fastening system in accordance with ASTM C1063 into wood or metal studs. Install drainage material with filter fabric mortar screen to exterior.

B. Install metal lath with rainscreen drainage material in accordance with the manufacturer's instructions.

3.05 INSTALLATION - SCRATCH COAT

A. Apply mortar scratch coat of 1/2 inch nominal to cover metal lath in accordance with ASTM C926. Scratch surface when somewhat firm. If scratch coat dries before applying setting bed mortar and manufactured stone units, moisten scratch coat by misting it with water.

3.06 INSTALLATION - MANUFACTURED STONE VENEER

A. Install manufactured stone units with a cementitious mortar setting bed to a scratch coat backing surface, in accordance with AMSMV manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51.

B. Mortar Joints: Raked.
1. Style: Standard 1/2 inch tooled.

C. Caps: Install capstones where located on drawings.

D. Seal all joints at wall openings and penetrations with sealant approved for use with manufactured stone .

3.07 INSTALLATION - MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

B. Extend metal flashings through exterior face of manufactured stone veneer and terminate in a flat drip with hemmed edge.

3.08 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

3.09 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Clean in accordance with manufacturer's installation instructions.

3.10 PROTECTION

A. Protect finished work from rain during and for 48 hours following installation.

B. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes structural steel and grout.

B. Related Sections:

1. Division 05 Section "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Moment Connections: Type FR, fully restrained.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer, fabricator, and testing agency.

B. Welding certificates.

C. Mill test reports for structural steel, including chemical and physical properties.

D. Source quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 572/A 572M, Grade 50 (345).

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. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Straight.

2. Finish: Plain.

E. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Finish: Plain.

F. Threaded Rods: ASTM A 36/A 36M.

1. Finish: Plain.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, 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 360.

B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

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/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

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 (50 mm).

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 (applied fireproofing).

5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."

2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.8 SOURCE QUALITY CONTROL

A. Testing Agency: 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/D1.1M 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, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedded items for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: 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/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: 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/D1.1M.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 051200

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items, including:
   1. Bollards.
   2. Lintels and angles.
   3. Trash enclosure gates and posts.

B. Prefabricated Entry Canopies.

C. Miscellanious structural connectors.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

E. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

F. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

G. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014.

H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (Errata 2016).

I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

K. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product data: Submit manufacturer's data on products showing compliance with specified requirements and installation instructions.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Pipe: ASTM A53/A53M, Grade B Schedule 40, hot-dip galvanized finish.

D. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

E. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

F. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

B. Gate Posts and Gates for trash enclosure: Steel, angle and tube sections with sheet metal skin; prime paint finish.
   1. Provide all gate hardware including cane bolts, lock hasp, and hinges.

C. Ledge Angles and Lintels Not Attached to Structural Framing: For support of masonry; prime paint finish.

2.04 ENTRY CANOPIES

A. Pre-engineered steel entry canopy consisting of 16 gauge frame, 24 gauge steel deck, hanging rods, and hardware; factory finished.
   1. Width: As indicated on drawings.
   2. Projection: 3 feet
   3. Drains: Front facing.
   4. Finish: Baked enamal.
   5. Color: Black.
   6. Manufacturer:
      a. Design Components, Inc: www.designcomponents.com.

2.05 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete and items to be imbedded in masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.06 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 52 13

METAL RAILINGS AND GUARDRAILS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

C. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013.

D. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

E. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

F. UFAS - Uniform Federal Accessibility Standards - HUD 24 CFR part 40; 1984.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store shop-fabricated components under waterproof cover and elevated above grade, on a flat surface.

B. Separate components with solid blocking to minimize damage to shop-applied primer.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 50 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.

C. Dimensions: See drawings for Pipe and Tube railing configurations and heights.
   1. Hand Rails and Wall Rails: 1-1/2 inches, diameter round.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
   2. For anchorage to stud walls, provide backing plates, for bolting anchors.
   3. Posts: Provide adjustable flanged brackets.

E. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

F. Finish: Shop-primed painted.

2.02 STEEL MATERIALS

A. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing.

B. Handrail Brackets: Wall-mount cast bracket w/ one 7/16 inch mounting hole; malleable iron.
   1. Projection: 2-1/2 inches.
   2. Manufacturer:
      a. Julius Blum & Co; # 382: www.juliusblum.com

C. Welding Fittings: Factory or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2.04 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC-SP 2, Hand Tool Cleaning.
   2. Number of Coats: Two (2).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with UFAS and ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

E. Field weld anchors as indicated on shop drawings. Grind welds smooth; Touch-up welds with primer.

F. Conceal anchor bolts and screws whenever possible.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 061000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Shear wall panels.
4. Rooftop equipment bases and support curbs.
5. Wood blocking, cants, and nailers.
6. Wood furring and grounds.
7. Wood sleepers.
8. Plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Powder-actuated fasteners.
7. Expansion anchors.
8. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship for the following:

1. Dimension lumber framing.
2. Laminated-veneer lumber.
3. Parallel-strand lumber.
4. Prefabricated wood I-joists.
5. Rim boards.

6. Miscellaneous lumber.

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.

3. Provide dressed lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

D. 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, which meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by ration engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.

5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. **Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.**

1. **Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.**
2. **Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.**

C. **Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.**

D. **Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.**

E. **Application: Treat items indicated on Drawings, and the following:**

1. **Framing for raised platforms.**
2. **Framing for stages.**
3. **Concealed blocking.**
4. **Framing for non-load-bearing partitions.**
5. **Framing for non-load-bearing exterior walls.**
6. **Roof construction.**
7. **Plywood backing panels.**

2.4 DIMENSION LUMBER FRAMING

A. **Non-Load-Bearing Interior Partitions: Standard, Stud, or No. 3 grade.**

1. **Application: Interior partitions not indicated as load-bearing.**
2. **Species:**
   a. **Mixed southern pine; SPIB.**
   b. **Northern species; NLGA.**
   c. **Eastern softwoods; NeLMA.**
   d. **Western woods; WCLIB or WWPA.**

B. **Framing Other Than Non-Load-Bearing Interior Partitions: As shown on the drawings.**

1. **Application: Framing other than interior partitions not indicated as load-bearing.**
2. **Species:**
   a. **Hem-fir (north); NLGA.**
   b. **Southern pine; SPIB.**
   c. **Douglas fir-larch; WCLIB or WWPA.**
   d. **Mixed southern pine; SPIB.**
   e. **Spruce-pine-fir; NLGA.**
   f. **Douglas fir-south; WWPA.**
   g. **Hem-fir; WCLIB or WWPA.**
   h. **Douglas fir-larch (north); NLGA.**
   i. **Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.**

C. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. **Application: Exposed exterior and interior framing indicated to receive a stained or natural finish.**
2. **Species and Grade: As indicated above for load-bearing construction of same type.**

2.5 ENGINEERED WOOD PRODUCTS

A. Engineered Wood Products, General: Products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

1. **Extreme Fiber Stress in Bending, Edgewise: As shown on drawings.**
2. **Modulus of Elasticity, Edgewise: As shown on drawings.**

C. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Provide units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.

1. **Web Material: Either oriented strand board or plywood, complying with DOC PS 1 or DOC PS 2, Exposure.**
2. **Structural Properties: Provide units with depths and design values not less than those indicated.**
3. **Provide units complying with APA PRI-400, factory marked with APA trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA standard.**

D. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.

1. **Material: Product made from any combination solid lumber, wood strands, and veneers.**
2. **Thickness: 1-1/4 inches (32 mm).**
3. **Provide performance-rated product complying with APA PRR-401, rim board grade, factory marked with APA trademark indicating thickness, grade, and compliance with APA standard.**

2.6 SHEAR WALL PANELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. **Shear Transfer Systems.**
2. **Simpson Strong-Tie Co., Inc.**
3. **Weyerhaeuser Company.**

Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.

4. **Products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."**

C. Steel-Framed Shear Wall Panels: Prefabricated assembly consisting of cold-formed galvanized steel panel, steel top and bottom plates, and wood studs.

D. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, which 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.

2.7 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. **Blocking.**
2. **Nailers.**
3. **Rooftop equipment bases and support curbs.**
4. **Cants.**
5. **Furring.**
6. **Grounds.**

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. **Mixed southern pine; No. 2 grade; SPIB.**
2. **Eastern softwoods; No. 2 Common grade; NeLMA.**
3. **Northern species; No. 2 Common grade; NLGA.**
4. **Western woods; Construction or No. 2 Common; WCLIB or WWPA.**

2.8 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, AC in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

1. **Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."**

2.9 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, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.**

B. Power-Driven Fasteners: NES NER-272.

C. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.10 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cleveland Steel Specialty Co.

2. KC Metals Products, Inc.

3. Phoenix Metal Products, Inc.

4. Simpson Strong-Tie Co., Inc.

5. USP Structural Connectors.

C. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, which 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.

D. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

E. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.11 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

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 furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

E. Shear Wall Panels: Install shear wall panels to comply with manufacturer's written instructions.

F. **Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.**

G. **Do not splice structural members between supports unless otherwise indicated.**

H. **Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.**

I. **Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.**

J. **Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:**

1. **NES NER-272 for power-driven fasteners.**
2. **Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.**
3. **Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.**

3.2 PROTECTION

A. **Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.**

B. **Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.**

END OF SECTION 061000

SECTION 061753

SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood roof trusses.
2. Wood floor trusses.
3. Wood girder trusses.
4. Wood truss bracing.
5. Metal truss accessories.

B. Allowances: Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance as specified in Division 01 Section "Allowances."

1.2 ACTION SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Evaluation Reports: For the following, from ICC-ES:

1. Metal-plate connectors.
2. Metal truss accessories.

1.4 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that [participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-

party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design metal-plate-connected wood trusses.

B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

2.2 DIMENSION LUMBER

A. Certified Wood: For metal-plate-connected wood trusses and permanent bracing, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

C. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 06 Section "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. Alpine Engineered Products, Inc.; an ITW company.

2. Cherokee Metal Products, Inc.; Masengill Machinery Company.

3. CompuTrus, Inc.

4. Eagle Metal Products.

5. Jager Building Systems, Inc.; a Tembec/SGF Rexfor company.

6. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.

7. Robbins Engineering, Inc.

8. Truswal Systems Corporation; an ITW company.

B. General: Fabricate connector plates to comply with TPI 1.

C. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, 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.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.

C. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those [indicated] [of basis-of-design products] [of products of manufacturers listed]. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

D. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

2.6 FABRICATION

A. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

B. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

F. Securely connect each truss ply required for forming built-up girder trusses.

G. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Division 06 Section "Rough Carpentry."

2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

H. Install wood trusses within installation tolerances in TPI 1.

I. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

J. Replace wood trusses that are damaged or do not meet requirements.

END OF SECTION 061753

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood casings and moldings.

C. Cellular PVC casings and moldings (exterior).

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Samples: Submit two samples of wood trim 6 inch long.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect from moisture damage.

B. Store flat, on level area, to prevent warping.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

B. Interior Finish Carpentry Items (Dwelling Units):
   1. Manufacturers: Acceptable millwork manufacturers of casings, molding and trim.
      a. Woodgrain Millwork; www.woodgrain.com.
      b. Trimco Millwork; www.trimcomillwork.com.
      c. Metrie Inc.; www.metrei.com
   2. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine, solid or finger jointed; primed for paint finish, in profiles as scheduled below:
      a. Door Trim: 11/16 inch x 2-1/4 inch Colonial Wood Casing.
      b. Baseboard Trim: 9/16 inch by 5-1/4 inch Colonial Wood Base.
      c. Window Sill: Composite resin (Cultured Marble) as specified in Section 12 35 30.
         1) Width: 4 inch.
         2) Profile: Eased edges.

C. Interior Finish Carpentry Items (Common Areas):
   1. Manufacturers: Acceptable millwork manufacturers of casings, molding and trim.
      a. Woodgrain Millwork; www.woodgrain.com.
      b. Trimco Millwork; www.trimcomillwork.com.
      c. Metrie Inc.; www.metrei.com
   2. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine, solid or finger jointed; primed for paint finish, in profiles as scheduled below:
      a. Door Trim: 11/16 inch x 2-1/4 inch Colonial Wood Casing.
      b. Baseboard Trim: 9/16 inch by 5-1/4 inch Colonial Wood Base.
      c. Window Sill: Composite resin (Cultured Marble) as specified in Section 12 35 30.
         1) Width: 4 inch.
         2) Profile: Eased edges.

2.02 LUMBER MATERIALS

A. Softwood Lumber: Clear White Pine species, plain sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

2.03 ACCESSORIES

A. Lumber for Shimming, Blocking, and Bracing: Softwood lumber of indicated species.

B. Primer: As specified in Section 09 91 23.

C. Wood Filler: Solvent base, tinted to match surface finish color.

D. Epoxy Filler: As recommended by composite resin manufacturer, to match color of window sills.

2.04 HARDWARE

A. Countertop Support Brackets: Fixed, L-shaped, corner reinforced, face-of-stud mounting.
   1. Material: Steel.
      a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
      b. Color: Black.
      c. Support Length: 24 inches.
   2. Products:
      a. A&M Hardware, Inc; Standard Brackets: www.aandmhardware.com.

2.05 FABRICATION

A. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Set and secure materials and components in place, plumb and level.

B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

C. Install prefinished paneling with full bed contact adhesive applied to substrate.

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 91 13 and 09 91 23.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 63 00
VINYL RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior patio and balcony railings.

1.02 REFERENCE STANDARDS

A. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2010.

B. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds; 2011.

C. ASTM D7032 - Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite and Plastic Lumber Deck Boards, Stair Treads, Guards, and Handrails; 2017.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. Manufacturer's Installation Instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Comply with manufacturer's recommendations. Handle materials to avoid damage.

1.05 WARRANTY

A. Railing Warranty: Provide manufacturer's standard 10 year warranty.

B. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Vinyl Handrails and Railings:
   1. Amerimax /Yardcrafters; Pro Deck Low Profile Classic: www.amerimax.com.
   2. Azek Building Products, Inc: Trademark Rail: www.azek.com.
   3. Enduris Inc.; Manhattan (Series 200): www.enduris.com.
   4. Intex Millwork Solutions LLC; Liberty system: www.intexmillwork.com.
   5. Kroy Building Products/PlyGem; Standard Rail: www.plygem.com

2.02 VINYL GUARDRAIL SYSTEMS

A. Performance Requirements:
   1. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 125 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set, when tested in accordance with ASTM D7032.
   2. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set, when tested in accordance with ASTM D7032.

B. Design Requirements:
   1. Allow for expansion and contraction of members and building movement without damage to connections or members.
   2. Provide anchors and other components as required to attach to structure; where exposed fasteners are unavoidable provide flush countersunk fasteners.

C. Rails:
   1. Top Rail: Capped cellular PVC over extruded aluminum support rail.

D. Newel Posts: Provide post mounts, caps, and trim required for the installation.
   1. Post Size: 4 by 4 inch.
   2. Post Cap Style: Pyramid.

E. Railing Infill:
   1. Baluster:
      a. Material: PVC.
      b. Profile: Square.

F. Texture: Molded, wood grain.

G. Color: To be selected by Owner from manufacturer's standard range.

H. Exposed Fasteners: Flush countersunk screws or bolts.

2.03 MATERIALS

A. Railing Components: Cellular PVC plastic with no cellulose fiber molded into solid shapes in standard railing sizes and profiles.
   1. Poly Vinyl Chloride (PVC); Impact-resistant and ultraviolet (UV) stable extruded product; comply with ASTM D1784.
   2. Recycled content: 95 percent.
   3. Surface Burning Characteristics: Flame spread index of 200, maximum; smoke developed index of 285, maximum; when tested in accordance with ASTM E84.

B. Aluminum: Support rails and pickets: Aluminum extrusions; alloy and temper 6063-T6 complying with ASTM B429/B429M.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: Stainless steel, trim head.
   2. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that railing locations and substrates are ready to receive work.

3.02 INSTALLATION

A. Install according to manufacturer's written instructions, and applicable ICC-ES report.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

END OF SECTION

SECTION 06 66 00

ORNAMENTAL SIMULATED WOODWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative Column Covers.

1.02 REFERENCE STANDARDS

A. ASTM D1435 - Standard Practice for Outdoor Weathering of Plastics.`

B. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2016.

C. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics; 2016.

D. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

E. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position; 2016.

F. ASTM D6864 - Standard Specification for Color and Appearance Retention of Solid Colored Plastic Siding Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, configurations, and material characteristics.

C. Shop Drawings: Submit detailed drawings showing location, profiles and product components, including but not limited to anchorage requirements, accessories and provisions for achieving desired finishes.

D. Samples: Submit two color samples to Architect & Owner for selection.

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. Manufacturer's Qualification Statement.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 10 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.

B. Store products in manufacturer's unopened packaging, under cover and elevated above grade.

C. Store products on flat level surface to prevent warping.

D. Protect products from damage due to related construction activities

1.06 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.

1. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Allow at least 24 hours for materials to adapt to conditions at project site prior to installation.

1.07 WARRANTY

A. Upon completion of work, provide a written Manufacturer’s Limited Lifetime Warranty for products installed under this section to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Factory-Fabricated Cellular PVC Column Covers:
   1. Azek Building Products; 3-Plus-1: www.azekexteriors.com.
   2. Elite Trimworks Inc.; Classic Non-Tapered: www.elitetrimworks.com.
   3. Versatex Building Products LLC; Classic Series: https//versatex.com.
   4. HB&G Building Products Inc.; PermaWrap Series: www.hbgcolumns.com.
   5. Or Approved Equal.

2.02 SIMULATED WOOD PRODUCTS

A. Factory-Fabricated Cellular PVC Column Covers:
   1. Premanufactured multi-piece, molded cellular PVC column cover, base and capital; UV stabalized, suitable for paint finish.
      a. Style: As indicated on the Drawings.
      b. Size: 8 inch x 8 inch, straight.
      c. Column Overall Height: As indicated on drawings.
      d. Column Wall Thickness: 1/2 inch.
      e. Shaft, Cap, and Base Construction: Two corner halves for field assembly.

2.03 MATERIALS

A. Cellular PVC, Extruded, expanded PVC; UV-resistant, heat-stabilized, and rigid material.
   1. Density: 31 pounds per cubic foot, minimum.
   2. Surface Burning Characteristics: Flame spread index of 75 maximum, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   3. Deflection/Warping: ASTM D648, Not less than 130 deg F.
   4. Water Absorption: ASTM D570, less than 0.2 percent.

B. Polypropylene, Molded high-density, UV stabilized.
   1. Density: 4 pounds per cubic foot, minimum.
   2. Surface Burning Characteristics: Flame spread index of 75 maximum, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   3. Compressive Strength: Minimum 300 pounds per sq. inch.

2.04 ACCESSORIES

A. Fasteners:
   1. Manufacturer's standard concealed fastners, galvanized steel.
   2. Screws; Manufacturer's standard corrosion resistant steel.

B. Adhesive:
   1. PVC plastic adhesive acceptable to manufacturer.

C. Sealant (Urethane foam products):
   1. Urethane-based adhesive acceptable to manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Prior to the start of installation, inspect all preceding work to ensure that there are no conditions which will cause an unsatisfactory installation of work.
   2. Notify Architect in writing of any unacceptable conditions that would adversely affect installation or subsequent performance of these products.
   3. Do not install any work until unsatisfactory conditions are corrected.
   4. Commencement of work will imply acceptance of substrate.

3.02 PREPARATION

A. Protection of In-Place Conditions: Protect adjacent surfaces and work to prevent damage during installation.

B. Surface Preparation:
   1. Clean surfaces thoroughly prior to installation.

2. Prepare surface using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Offset From True Alignment and plumb: 1/4 inch.

3.05 FIELD QUALITY CONTROL

A. After installation, check all work for flaws and defects.

B. Repair all defective work.

1. Remove and replace all damaged components that cannot be successfully repaired as determined by Architect.

3.06 CLEANING

A. Remove all protection materials.

B. Clean all surfaces following manufacturer’s recommendations prior to final project completion. Do not use harsh cleaning materials or methods that would damage finish.

C. Dispose properly of all debris generated by this work, protection materials and cleaning materials.

3.07 PROTECTION

A. Protect items installed under this section from subsequent construction operations.

END OF SECTION

SECTION 07 13 00
SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Self-adhered HDPE sheet membrane, post applied (For use at elevator pit walls).

1.02 REFERENCE STANDARDS

A. ASTM D751 - Standard Test Methods for Coated Fabrics; 2006 (Reapproved 2011).

B. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2012.

C. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2009.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants.

C. Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.05 WARRANTY

A. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 SHEET WATERPROOFING APPLICATIONS

A. Self-Adhered HDPE Sheet Membrane:
   1. Location: elevator-pit walls.
   2. Cover with protection board.

2.02 SHEET WATERPROOFING MATERIALS

A. Self-Adhered HDPE Sheet Membrane, Post-Applied: Recommended by manufacturer for placement on outside face of below grade concrete and concrete masonry unit (CMU) backfilled walls and select horizontal applications.
   1. Sheet Thickness: 30 mil, 0.030 inch, minimum, and with 20 mil, 0.020 inch thick adhesive.
   2. Hydrostatic Resistance: Resists pressure of 400 psi when tested in accordance with ASTM D751.
   3. Tensile Strength, Film: 5,000 psi, minimum, measured in accordance with ASTM D882.
   4. Adhesion: 150 psi, minimum, measured in accordance with ASTM D4541.
   5. Water Vapor Permeance: Less than 0.1 perm, measured in accordance with ASTM E96/E96M.
   6. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   7. Products:
      a. GCP Applied Technologies; Preprufe 800PA: www.gcpat.com.
      b. EPRO Services, Inc; PrimeTak: www.eproinc.com.
      c. Polyguard Products, Inc; 650 Sheet Membrane: www.polyguard.com.

2.03 ACCESSORIES

A. Seaming Materials: As recommended by membrane manufacturer.

B. Membrane Sealant: As recommended by membrane manufacturer.

C. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.

D. Protection Board: Provide type capable of preventing damage to waterproofing due to backfilling and construction traffic.
   1. Polystyrene foam board, 1 inch thick.
   2. Semi-rigid glass fiber board; unaffected by water, freeze-thaw, fungus, or soil bacteria; containing no formaldehyde, phenol, acrylic, or artificial color; 3/4 inch thick, nominal.
   3. Products:
      a. Mar-flex Waterproofing & Building Products; Drain & Dry: www.mar-flex.com/sle.
      b. W.R. Meadows, Inc; Protection Course: www.wrmeadows.com.
      c. Or approved equal.

E. Flexible Flashings: Type recommended by membrane manufacturer.

F. Adhesives: As recommended by membrane manufacturer.

G. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items penetrating surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.

E. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.

D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

H. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - PROTECTION BOARD

A. Adhere protection board to substrate with compatible adhesive.

3.05 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation in wall and floor/ceiling construction.

B. Foam insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

C. Foam or equal sill sealer insulation beneath bottom plate of all new exterior walls in contact with concrete.

1.02 REFERENCE STANDARDS

A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

B. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

D. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2016.

E. RESNET - Residential Home Energy Standards

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.04 QUALITY ASSURANCE

A. Formaldehyde Content: Contractor shall ensure that all products installed are certified Formaldehyde-Free by the manufacturer.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed on proposed products.
      b. Published product data showing compliance with requirements.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation in Wood Framed Walls: Batt insulation with integral Type II vapor retarder (kraft paper faced batts).

B. Insulation in Wood Framed Walls at openings and penetrations: Polyurethane expanding foam insulation.

C. Insulation in Wood Framed Floor/Ceiling Structure: Batt insulation with kraft paper facing.

2.02 BATT INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.

4. Thermal Resistance at exterior walls: R-value of 13 minimum.
5. Thickness at Unit Separation Walls: 3-1/2 inch for fire-rated assembly (each side).
6. Thickness at floor/ceilings: 3-1/2 inch for sound attenuation.
7. Facing: Kraft paper.
    a. Provide unfaced insulation at Unit Separation wall applications.
8. Products:
    a. CertainTeed Corporation: www.certainteed.com.
    b. Johns Manville: www.jm.com.
    c. Owens Corning Corporation: www.ocbuildingspec.com.

2.03 FOAM INSULATION

A. Single component polyurethane, low pressure foam sealant complying with ASTM E2178 for exterior wall penetrations.
    1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
    2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
    3. R-value; 1 inch of material at 72 degrees F: 4.7, minimum.
    4. Minimum Density: 1.0 pounds per cubic foot.
    5. Manufacturers:
        a. Dow Chemical Co.; Great Stuff: www.greatstuff.dow.com.
        b. FOMO Products Inc.; Handi Foam: www.fomo.com/handifoam.
        c. Touch 'n Seal Inc.; All Seasons: www.touch-n-seal.com.

B. Single component polyurethane, low pressure, low pressure build, foam sealant complying with ASTM E2178 for windows and doors.
    1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
    2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
    3. R-value; 1 inch of material at 72 degrees F: 4.7, minimum.
    4. Minimum Density: 1.10 pounds per cubic foot.
    5. Manufacturers:
        a. Dow Chemical Co.; Great Stuff Window & Door: www.greatstuff.dow.com.
        b. FOMO Products Inc.; Handi Foam Window & Door: www.fomo.com/handifoam.
        c. Touch 'n Seal Inc.; No Warp: www.touch-n-seal.com.

2.04 ACCESSORIES

A. Sheet Weather Barrier: See Section 07 25 00.

B. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
    1. Application: Sealing of interior circular penetrations, such as pipes or cables.
    2. Width: Are required for application.

C. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.
    1. Width: 3-1/2 inches.
    2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.

D. Insulation Fasteners: Lengths of unfinished, 13-gauge, 0.072-inch high carbon spring steel with chisel or mitered tips, held in place by tension, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

E. Staples: Steel wire; electroplated or galvanized; type and size to suit application.

F. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

C. Insulation shall be installed in accordance with North America Insulation Manufacturer's Association (NAIMA) RESNET Grade 1 requirements.

3.02 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall, floor/ceiling, and Dwelling Unit Separation wall spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Staple facing flanges in place at maximum 6 inches on center.
   1. Kraft paper-faced batt insulation in stud cavities of exterior walls.
   2. Tape seal butt ends, lapped flanges, and tears or cuts in facing.

F. Retain unfaced insulation batts in place with spindle fasteners at 12 inches on center.

G. Coordinate work of this section with construction of air barrier seal specified in Section 07 25 00.

3.03 FOAM INSULATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install expandable foam sealant to ensure continuity of building insulation envelope/thermal barrier.

C. Extra care shall be taken with installation of expandable foam sealant to prevent damage to surrounding work and installed items.
   1. Do not overfill gaps.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 21 26
BLOWN INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Attic: Blown insulation pneumatically placed into joist spaces.

1.02 REFERENCE STANDARDS

A. ASTM C739 - Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation; 2011.

B. ASTM C1015 - Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation; 2006 (Reapproved 2011).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and limitations.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Formaldehyde Content: Contractor shall ensure that all products installed are certified Formaldehyde-Free by the manufacturer.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed on proposed products.
      b. Published product data showing compliance with requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Blown Insulation:
   1. Applegate Insulation: www.applegateinsulation.com.
   2. Fiberlite Technologies, Inc: www.fiberlitetech.com.
   3. GreenFiber: www.greenfiber.com.
   4. Or approved equal.

2.02 MATERIALS

A. Refer to Specification/Selection Design sheets.

B. Applications: Provide blown insulation in attic as indicated on drawings.

C. Loose Fill Insulation: ASTM C739, cellulose fiber type, bulk for pneumatic placement.
   1. Thermal Transmittance (U-value): 0.27 BTU/hr sq ft deg F, maximum.
   2. Total Thermal Resistance at Attic:
      a. Dwelling Unit Building: R-value of 49 (deg F hr sq ft)/Btu, minimum.

2.03 ACCESSORIES

A. Roof Ventilation Baffles: Prefabricated ventilation channels for placement under roof sheathing with baffles to prevent wind-washing.
   1. Material: Polyvinyl chloride (PVC).
   2. Roof Joist/Truss Spacing: 24 inch on center, nominal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and adjacent materials are dry and ready to receive insulation.

B. Verify that light fixtures have thermal cut-out device to restrict over-heating in soffit or ceiling spaces.

C. Verify spaces are unobstructed to allow for proper placement of insulation.

3.02 INSTALLATION

A. Install insulation and ventilation baffle in accordance with ASTM C1015 and manufacturer's instructions.

B. Place insulation pneumatically to completely fill rafter spaces.

C. Place insulation against baffles, and do not impede natural attic ventilation to soffit.
   1. Insulation to cover top plates at exterior wall to a minimum installed depth of 6 inches.

D. Completely fill intended spaces leaving no gaps or voids.

3.03 FIELD QUALITY CONTROL

A. Insulation Certification - Contractor shall post in the attic of each building (near the attic access) Certification of Insulation Type, "R" value, conformance to applicable Federal Specifications, plus the date of installation and the name of the installer.

B. Installer shall install measuring “tape” for each 300 SF of attic area, stapled to side of truss webbing.

3.04 CLEANING

A. Remove loose insulation residue.

END OF SECTION

SECTION 07 25 00
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-resistive, vapor-permeable air and water barriers.

1.02 DEFINITIONS

A. Weather Barriers: Materials or assemblies forming water-resistive barriers, air barriers, vapor retarders, or combination of one or more assemblies.

B. Water-Resistive Barriers: Materials or assemblies installed behind exterior wall coverings; designed to prevent liquid water from further penetration into exterior wall assembly.

1.03 REFERENCE STANDARDS

A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

D. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.05 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 WATER-RESISTIVE AIR BARRIERS

A. Water-Resistive Air Barrier: For use in IBC Construction Types I, II, III, and IV on buildings greater than 40 feet in height.
   1. Comply with NFPA 285 wall assembly requirements in accordance with local building code and authorities having jurisdiction (AHJ).

B. Water-Resistive and Air Barrier, Multilayers: Outer layers of nonwoven, spunbonded polypropylene with vapor permeable, watertight polymeric middle layer.
   1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
   2. Water Vapor Permeance: 54 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.
   3. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 3 months of weather exposure.
   4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
   5. Seam and Perimeter Tape: As recommended by sheet manufacturer.
   6. Products:
      a. DuPont Building Innovations; Tyvek Home Wrap with FlexWrap NF, StraightFlash, StraightFlash VF, Tyvek Wrap Caps, and Tyvek Tape: www.dupont.com.
      b. Kingspan Insulation LLC; GreenGuard HPW Building Wrap with GreenGuard Butyl Flashing and GreenGuard SuperStretch Flashing: www.trustgreenguard.com.

c. National Shelter Products, Inc; DRYLine HP with Dryline Sheathing Tape, ATX Flashing, and ATX Flex Flashing: www.drylinewrap.com.

2.02 ACCESSORIES

A. Seal and Perimeter Tapes: As recommended by water-resistive barrier manufacturer.

B. Flexible Flashing: Self-adhering sheet flashing complying with ASTM D1970/D1970M; waive slip resistance requirement if not installed on roof.
   1. Width: 4 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Water-Resistive Air Barriers: Install continuous water-resistive barrier where indicated on drawings, with sheets lapped to shed water and with seams and joints sealed to adjacent surfaces.

C. Mechanically Fastened Sheets:
   1. Install sheets in shingle fashion to shed water; align horizontally.
   2. Overlap seams as recommended by manufacturer, 6 inches, minimum.
   3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.
   4. Attach to framed construction with fasteners extending through sheathing into framing, and space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
   5. For applications indicated to be airtight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners as recommended by manufacturer.
   6. Where stud framing rests on concrete or masonry substrate, extend lower edge of barrier sheets at least 4 inches below bottom of framing and seal to substrate with sealant or approved mounting tape.
   7. Install water-resistive barrier over jamb flashings.
   8. Install head flashings under water-resistive barrier.
   9. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.

D. Openings and Penetrations in Exterior Water-Resistive Air Barriers:
   1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
   3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
   4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
   5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.

6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

3.04 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

B. Protect installed weather barrier from any and all damage prior to installation of exterior cladding or veneers.
   1. Any and all rips, tears and/or punctures shall be repaired in accordance with manufacturer's written repair instructions.
   2. If damaged building wrap is not repairable, then follow manufacturer's written instructions for partial removal and "patching" of building wrap to maintain integrity of building wrap membrane.

END OF SECTION

SECTION 07 31 13
ASPHALT SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Impact-resistant Asphalt shingle roofing.

B. Flexible sheet membranes for underlayment and valley protection.

C. Metal flashings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.

C. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules; 2010a.

D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

E. ASTM D7158/D7158M - Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method); 2017.

F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

G. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2011.

H. ASTM F1667/F1667M - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2021a.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating material characteristics and performance criteria.

C. Manufacturer's Installation Instructions: Indicate installation criteria and procedures.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store materials with labels intact in manufacturer's unopened packaging until ready for installation.

B. Store materials under dry and waterproof cover, well ventilated, and elevated above grade on a flat surface.

C. When storing roofing materials on roofing system ensure that no damage occurs to supporting members and other materials.

1.06 FIELD CONDITIONS

A. Do not install shingles, underlayment when ambient air temperatures are below 45 degrees F.

1.07 WARRANTY

A. Provide manufacturer's standard, transferable warranty:
   1. Materials: Warrant shingles for 30 years against defect or deterioration that results in leaks under normal weather and use conditions.
   2. Installation: Warrant total roof system, including underlayments, flashings, and other roof components for 2 years against water penetration.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Asphalt Shingles:
   1. GAF; Timberline ArmorShield II: www.gaf.com.
   2. Tamko; Stormfighter Flex 3: www.tamko.com.
   3. Or approved equal.

2.02 ASPHALT SHINGLES

A. Asphalt Shingles, Impact-resistant: SBS-modified, Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
   1. Fire Resistance: Class A, complying with ASTM E108.
   2. Wind Resistance (Uplift): Class G, minimum, when tested in accordance with ASTM D7158/D7158M.
   3. Warranted Wind Speed: Not greater than 150 mph.
   4. Impact Resistance: Class 3 minimum.
   5. Fungal/Algae Resistant.
   6. Self-sealing type.
   7. Style: Laminated overlay.

2.03 SHEET MATERIALS

A. Valley Protection Membrane: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.

B. Eave Edge Starter Shingles: Glass felt base, with ceramic coated mineral granules tightly embedded in refined, water-resistant asphalt, complying with ASTM D3462/D3462M.
   1. Shingle Size: 7-5/8 by 38-3/4 inches, nominal.
   2. Products: By Manufacturer as required for wind resistance rating.

C. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams and meeting requirements of ASTM D226/D226M.
   1. Type: Woven polypropylene with anti-slip polyolefin coating on both sides.
   2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   3. Ultraviolet (UV) Resistance and Weatherability: Approved in writing by manufacturer for exposure to weather for minimum of two months.
   4. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
   5. Water Vapor Permeance: Vapor retarder; maximum of 1 perm, when tested in accordance with ASTM E96/E96M Procedure A, desiccant method.
   6. Fasteners: As recommended by manufacturer or building code qualification report or approval.
   7. Products:
      a. Beacon Roofing Supply Inc; Tri-Built Synthetic Underlayment: www.becn.com.
      b. System Components Corporation, Inc; ProTex: www.systemcomponents.net.
      c. Or approved equal.

D. Underlayment: Asphalt-saturated organic roofing felt, unperforated, complying with ASTM D226/D226M, Type I, No. 15.

2.04 METAL FLASHING

A. Metal Flashings: Provide sheet metal eave edge, gable board, facia board, and other flashing as indicated.
   1. Form flashings to protect roofing materials from physical damage and shed water.
   2. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
   3. Hem exposed edges of flashings minimum 1/4 inch on underside.

B. Facia and Gable Flashing: Pre-formed or site-fabricated sheet metal fascia and gable board cladding to cover entire exposed faces with no horizontal seams. Overlap vertical seams 2 inches.

C. Aluminum Flashing: Prefinished aluminum, 26 gauge, 0.017 inch minimum thickness; stucco embossed, PVC coating, color as selected by Owner.

2.05 ACCESSORIES

A. Roofing Nails: Standard round wire shingle type, galvanized steel, minimum 3/8-inch head diameter, 12-gauge, 0.109-inch nail shank diameter, 1-1/2 inches long and complying with ASTM F1667/F1667M.

B. Coil Nails: Standard round wire shingle type, barbed shank, of electro-galvanized steel, 11 - 12 wire gage, 0.125 - 0.109 inch shank diameter, 3/8 inch head diameter, of sufficient length to penetrate through roof sheathing or 3/4 inch into roof sheathing or decking.

C. Asphalt Roof Cement: ASTM D4586/D4586M, asbestos-free.

D. Ridge Vents: Plastic, corrugated with vent openings that do not permit direct water or weather entry; flanged to receive shingles; Vent-Sure manufactured by Owens Corning.
   1. Free Vent Area (net): 18 square inches per linear foot.
   2. Size: 1 inch high x 11-7/16 inch wide.

E. Roof Vents: Aluminum construction with nailing flange and insect screen; equal to Model RVA 50 manufactured by Air Vent Inc.
   1. Free Vent Area (net): 50 square inches.
   2. Size of Roof Opening: 8 inch round.
   3. Color: Color as selected by Owner/Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to starting this work.

B. Verify that roof deck is of sufficient thickness to accept fasteners.

C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

D. Verify roof openings are correctly framed.

E. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

A. Remove existing roofing, underlayment, flashings, nails, and all accessories to existing roof deck.

B. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.

C. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.

D. Broom clean deck surfaces before installing underlayment or eave protection.

E. Install eave edge and gable edge flashings tight with fascia boards. Weather lap joints 2 inches and seal with plastic cement. Secure flange with nails spaced 8 inches on center.

3.03 INSTALLATION

A. Underlayment:
   1. Roof Slopes Up to 4:12: Install two layers of underlayment over area not protected by eave protection, with ends and edges weather lapped minimum 6 inches; stagger end laps of each consecutive layer and nail in place through metal disks at 12 inches on center.
   2. Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches; stagger end laps of each consecutive layer, nail in place through metal disks at 12 inches, and weather lap minimum 4 inches over eave protection.
   3. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.

B. Valley Protection Membrane:
   1. Install one ply of flexible flashing, minimum 48 inches wide, centered over valleys.
   2. Install flexible flashing in accordance with manufacturer's instructions.

3. Weather lap joints minimum 4 inches.
4. Nail in place minimum 18 inches on center, 1 inch from edges.

C. Metal Flashing:
1. Install flashings in accordance with manufacturer's instructions.
2. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.
3. Secure in place with nails at 8 inches on center, and conceal fastenings.
4. At sidewall roof lines (where a sloped roof abuts a vertical wall surface) “kickout flashing” shall be installed in accordance with the siding manufacturer written Installation Requirements
5. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

D. Shingles:
1. Install shingles in accordance with manufacturer's instructions.
a. Fasten individual shingles using two nails per shingle, or as required by manufacturer and local building code, whichever is greater.
b. Fasten strip shingles using four nails per strip, or as required by manufacturer and local building code, whichever is greater.
2. Place shingles in straight coursing pattern with 5-inch weather exposure to produce double thickness over full roof area, and provide double course of shingles at eaves.
3. Project first course of shingles 1/2 inch beyond fascia boards.
4. Extend shingles 1/2 inch beyond face of gable edge fascia boards.
5. Extend shingles on one slope across valley and fasten; trim shingles from other slope 2 inches from valley center line to achieve closed cut valley, concealing valley protection.
6. Cap hips and ridges with pre-formed ridge and hip shingles, maintaining 5-inch weather exposure, and place to avoid exposed nails.
7. Coordinate installation of roof mounted components or work projecting through roof with weathertight placement of counterflashings.
8. Complete installation to provide weathertight service.

E. Vents:
1. Ridge vent openings and ridge vent material shall not be located less than 24 inches from end of ridge.
2. Roof vents shall be located on the rear-facing slope of roof, within 24 inches of the ridge. Installation to be evenly spaced across the width of attic areas contained between rated partitions.

3.04 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Clean exposed work upon completion of installation; remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to finish.

END OF SECTION

SECTION 07 46 46
FIBER-CEMENT SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiber-cement siding.

B. Aluminum Ceilings, Soffits, and Trim.

1.02 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

C. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets; 2008 (Reapproved 2012).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
   1. Manufacturer's requirements for related materials to be installed by others.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods, including nail patterns.

C. Warranty: Submit copy of manufacturer’s warranty, made out in Owner’s name, showing that it has been registered with manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store materials in manufacturer's unopened packaging, with labels intact, until ready for installation.

B. Store materials under dry and waterproof cover, well ventilated, and elevated above grade on a flat surface.

1.05 WARRANTY

A. Extended Correction Period: Correct defective work within 5-year period commencing on Date of Substantial Completion.

B. Manufacturer Warranty: Provide manufacturer warranty for years as indicated under Fiber-Cement Siding article sub-headings for "Warranty". Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 FIBER-CEMENT SIDING

A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, in compliance with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Style: Standard lap style.
   2. Texture: Simulated cedar grain.
   3. Length: 12 feet, nominal.
   4. Width (Height): 9-1/2 inches.
   5. Thickness: 7/16 inch, nominal.
   6. Finish: Factory applied primer.
   7. Warranty: 50 year limited; transferable.
   8. Products:
      a. Allura, a division of Plycem USA, Inc: www.allurausa.com.
      b. James Hardie Building Products, Inc: www.jameshardie.com.
      c. Nichiha USA, Inc: www.nichiha.com.

d. Or approved equal.

B. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Style: V-Groove
   2. Texture: Simulated cedar grain.
   3. Length (Height): 96 inches, nominal.
   4. Width: 48 inches.
   5. Thickness: 5/16 inch, nominal.
   6. Finish: Factory applied primer.
   7. Warranty: 50 year limited; transferable.
   8. Products:
      a. Same as siding.

C. Aluminum Ceilings: Prefinished Aluminum complying with ASTM B209 ; 2-coat fluoropolymer polyester coating, AAMA 2604, thermally cured.
   1. Profile: 16 inch Quad-4, 3/8 inch depth; Solid.
   2. Thickness: 26 gauge, (0.016 inch).
   3. Length: 120 inches, nominal.
   4. Finish: Smooth.
   5. Color: As selected from manufacturer's full range of available colors.
   6. Accessories: 'J'-channel; starter strip; associated trim.
   7. Manufacturers:
      a. Napco (a PlyGem Inc. company): www.napcoproducts.com.
      b. Alside Inc.: www.alside.com.
      c. Fabral Inc.: www.fabral.com.
      d. Or approved equal.

D. Aluminum Soffit: Prefinished Aluminum complying with ASTM B209 ; 2-coat fluoropolymer polyester coating, AAMA 2604, thermally cured.
   1. Profile: 16 inch Quad-4, 3/8 inch depth; Fully-vented.
   2. Thickness: 26 gauge, (0.016 inch).
   3. Net Free Vent Area: 9 sq. in. per linear foot, minimum.
   4. Finish: Smooth.
   5. Color: As selected from manufacturer's full range of available colors.
   6. Accessories: 'J'-channel; starter strip; associated trim.
   7. Manufacturers: Same as ceiling panels.

2.02 ACCESSORIES

A. Trim: Same material and texture as siding.

B. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inches, minimum.

C. Flashing: Aluminum, 26 gage, 0.0179 inch minimum base metal thickness.

D. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.

E. Finish Paint: Latex house paint acceptable to siding manufacturer; primer recommended by paint manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.

B. Verify that weather air barrier has been installed over substrate completely and correctly.

C. Do not begin until unacceptable conditions have been corrected.

D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Protect surrounding areas and adjacent surfaces during execution of this work.

B. Install Sheet Metal Flashing:
   1. Above door and window trim and casings.
   2. Above masonry or manufactured stone veneer termination.

3.03 INSTALLATION

A. Install siding in accordance with manufacturer's instructions and recommendations.
   1. Read warranty and comply with terms necessary to maintain warranty coverage.
   2. Use trim details as indicated on drawings.
   3. Touch up field cut edges before installing.
   4. Pre-drill nail holes if necessary to prevent breakage.

B. Over Wood and Wood-Composite Sheathing: Fasten siding through sheathing into studs.

C. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.

D. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.

E. Do not install siding less than 6 inches from surface of ground nor closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.

F. Attach soffits securely to framing, not sheathing, with horizontal components true to level, providing a weather resistant installation.
   1. Provide trim and associated hardware as required for surface-mounted and/or recessed installation of exterior lights at soffit panels.
   2. Provide vent area shown on drawings.

G. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

H. Finish Painting: See Section 09 91 13.

3.04 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, and other items as required.

B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

C. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2015a.

D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

E. CDA A4050 - Copper in Architecture - Handbook; current edition.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B209M, 3005 alloy, H12 or H14 temper; 26 gauge, 0.017 inch thick; plain finish shop pre-coated with silicone modified polyester coating.

1. Silicone Modified Polyester Coating: Pigmented organic powder coating, AAMA 2603; baked enamel finish system.

2.02 FABRICATION

A. General: Provide prefinished aluminum sheet metal flashing at changes in adjacent siding materials and other flashing indicated, color as selected by Owner/Architect.

B. Form sections true to shape, accurate in size, square, and free from distortion or defects.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

F. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.03 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Underlayment: ASTM D2178/D2178M, glass fiber roofing felt.

C. Primer Type: Zinc chromate.

D. Concealed Sealants: Non-curing butyl sealant.

E. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

F. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready to receive work.

B. Verify that water-resistive barrier has been installed over substrate completely and correctly.

C. Do not begin until unacceptable conditions have been corrected.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Seal metal joints watertight.

END OF SECTION

SECTION 07 71 23

MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-finished aluminum gutters and downspouts.

B. Precast concrete splash blocks.

1.02 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on prefabricated components.

C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

D. Samples: Submit two samples, 6 inch long illustrating component design, finish, color, and configuration.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pre-Finished Aluminum Sheet: ASTM B209/B209M, 3005 alloy, H14 temper; 0.032 inch thick.
   1. Finish: Plain, shop pre-coated with acrylic coating.
   2. Color: As selected from manufacturer's standard colors.

2.02 COMPONENTS

A. Gutters: 6 inch K-style profile.

B. Downspouts: 3 inch by 4 inch Rectangular profile, minimum.

C. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Gutter Supports: Straps.
   2. Downspout Supports: Straps.

D. Fasteners: Same material and finish as gutters and downspouts, with soft neoprene washers.

2.03 FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

2.04 FINISHES

A. Acrylic polyester coating: Baked enamel system complying with AAMA 2603.

2.05 ACCESSORIES

A. Splash Blocks: Precast concrete type, size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
   1. Size: 3 inch by 12 inch by 30 inch
   2. Manufacturer: Equal to Nitterhouse Masonry Products, LLC: www.nitterhousemasonry.com.
   3. Profile No: 36" Splash Block.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

A. Paint concealed sheet metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Slope gutters 1/8 inch per foot, 2 percent minimum.

C. Set splash blocks under downspouts.

END OF SECTION

SECTION 07 81 00

APPLIED FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applied fire protection of interior structural steel not exposed to damage or moisture.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

B. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2000 (2015)e1.

C. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2015)e1.

D. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2015).

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

F. UL (FRD) - Fire Resistance Directory; current edition.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with placement of mechanical component hangers and electrical components.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data indicating product characteristics.

C. Manufacturer's Certificate: Certify that applied fireproofing products meet or exceed requirements of Contract Documents.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Field Quality Control Submittals: Submit field test report.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience

1.06 FIELD CONDITIONS

A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F or when temperature is predicted to be below said temperature for 24 hours after application.

B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

C. Provide temporary enclosure to prevent spray from contaminating air.

1.07 WARRANTY

A. Correct defective Work within a two year period after Date of Substantial Completion.
   1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
   2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Applied Fire Protection:
   1. Unishield International, LLC; UNIFIREX F-10: www.universalfireshield.com.

2.02 APPLIED FIRE PROTECTION ASSEMBLIES

A. Provide fire resistance ratings for following building elements as required by local building code:
   1. Primary structural frame, including columns, and beams 1 hour.

2.03 MATERIALS

A. Applied Fire Protection Material for Interior Applications, Concealed: Manufacturer's standard factory mixed material, which when combined with water is capable of providing indicated fire resistance, and complying with following requirements:
   1. Composition: Gypsum-based; not mineral-fiber-based.
   2. Bond Strength: 150 pounds per square foot, minimum, when tested in accordance with ASTM E736/E736M when set and dry.
   3. Dry Density: As required by fire resistance design.
   4. Compressive Strength: 8.33 pounds per square inch, minimum.
   5. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
   6. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
   7. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
   8. Fungal Resistance: No growth after 28 days when tested according to ASTM G21.

2.04 ACCESSORIES

A. Primer Adhesive: Of type recommended by applied fire protection manufacturer.

B. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive fireproofing.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.

D. Verify that voids and cracks in substrate have been filled.

3.02 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.

D. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

E. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

A. Apply primer adhesive in accordance with manufacturer's instructions.

B. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.

3.04 FIELD QUALITY CONTROL

A. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.
   1. Submit field test reports promptly to Contractor and Architect.

B. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).

C. Repair or replace applied fireproofing at locations where test results indicate fireproofing does not meet specified requirements.

D. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.05 CLEANING

A. Remove excess material, overspray, droppings, and debris.

B. Remove fireproofing from materials and surfaces not required to be fireproofed.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not.

1.02 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.

B. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2014b.

C. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a (Reapproved 2015).

D. ITS (DIR) - Directory of Listed Products; current edition.

E. FM (AG) - FM Approval Guide; current edition.

F. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

G. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Certificate from authority having jurisdiction indicating approval of materials used.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD) will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Trained by manufacturer.

1.05 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. 3M Fire Protection Products; Fire Barrier: www.3m.com/firestop.
   2. A/D Fire Protection Systems Inc; A/D Fire Barrier: www.adfire.com.
   3. Dow Corning; Fire Stop: www.dowcorning.com
   4. Hilti, Inc; FS-ONE, FS-ONE MAX: www.hilti.com.
   5. RectorSeal Corporation; FlameSafe: www.flamesafe.rectorseal.com
   6. Specified Technologies Inc; SpecSeal: www.stifirestop.com.
   7. Or approved equal..

2.02 MATERIALS

A. Firestopping: Any material meeting requirements.

B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. The following listed UL Fire Rated Penetration Systems are provided for the Contractor's use in selecting the appropriate system for field conditions and F Rating of penetrated assemblies.
   1. Contractor is not limited to using only these fire rated systems.
   2. Contractor shall provide proper documentation upon request of the Owner/Architect or Authorities having jurisdiction over project.

B. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Temperature Rise: For horizontal rated assemblies (Floor/Ceiling), provide systems that have been tested to show T Rating equal to required F Rating.
      a. Systems contained and located within the cavity of a wall, T Rating is not required.
   2. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

C. Additional related information is provided on MEP Drawings.

2.04 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Penetrations By:
   1. Multiple Penetrations in Large Openings:
      a. 2 Hour Construction: UL System W-L-3282; Hilti CFS-PL Firestop Plug.
   2. Uninsulated Metallic Pipe, Conduit, and Tubing:
      a. 2 Hour Construction: UL System W-L-1049; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
      b. 2 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      c. 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      d. 1 Hour Construction: UL System W-L-1001; 3M CP 25 WB.
      e. 1 Hour Construction: UL System W-L-1312; RectorSeal FlameSafe Silicone NS.
      f. 1 Hour Construction: UL System W-L-1222; STI SpecSeal LCI sealant.
      g. 1 Hour Construction: UL System W-L-1066; A/D Fire Protection FireBarrier Silicone.
   3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
      a. 2 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      b. 2 Hour Construction: UL System W-L-2243; Specified Technologies Inc. SSW Wrap Strips.
      c. 2 Hour Construction: UL System W-L-1038; RectorSeal FS 1900 Sealant.
      d. 2 Hour Construction: UL System W-L-2155; A/D Fire Protection FireBarrier Collar.
      e. 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop.
      f. 1 Hour Construction: UL System W-L-1038; RectorSeal FSP 1100 Putty.
      g. 1 Hour Construction: UL System W-L-2167; RectorSeal FlameSafe Wrap Strip.
      h. 1 Hour Construction: UL System W-L-2048; STI SpecSeal BLU or RED.
      i. 1 Hour Construction: UL System W-L-2155; A/D Fire Protection FireBarrier Collar.
   4. Electrical Cables Not In Conduit:
      a. 2 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
      b. 2 Hour Construction: UL System W-L-3076; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
      c. 2 Hour Construction: UL System W-L-3303; Specified Technologies Inc. Ready Split Sleeve.
      d. 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.

e. 1 Hour Construction: UL System W-L-3024; Specified Technologies Inc. SSP Firestop Putty.
f. 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
g. 1 Hour Construction: UL System W-L-3076; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
h. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
i. 1 Hour Construction: UL System W-L-3376; Specified Technologies Inc. Ready-Sleeve.

2.05 FIRESTOPPING PENETRATIONS THROUGH FLOOR-CEILING ASSEMBLIES

A. Penetrations by:
1. Uninsulated Metallic Pipe, Conduit, and Tubing:
a. 2 Hour Construction: UL System F-C-1002; 3M CP 25WB+.
b. 2 Hour Construction: UL System F-C-1020; RectorSeal FlameSafe FS 1900, Metacaulk 1000.
c. 2 Hour Construction: UL System F-C-1149; A/D Fire Protection A/D FireBarrier Intumescent Sealant.
d. 1 Hour Construction: UL System F-C-1002; 3M CP 25WB+.
e. 1 Hour Construction: UL System F-C-1053; STI SpecSeal WF300 Caulk.
f. 1 Hour Construction: UL System F-C-1150: A/D Fire Protection A/D FireBarrier Intumescent Sealant.
2. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
a. 2 Hour Construction: UL System F-C-2115; 3M FS-195+, Ultra GS.
b. 2 Hour Construction: UL System F-C-2041; RectorSeal FS 1900 Sealant, Metacaulk MC 150+, FSD Devise.
c. 2 Hour Construction: UL System F-C-2020; STI SpecSeal SSS Sealant, LCI Sealant, Firestop collar, LCC Firestop collar.
d. 1 Hour Construction: UL System F-C-2002; 3M FS-195+, CP 25WB.
e. 1 Hour Construction: UL System F-C-2115; 3M FS-195+, Ultra GS.
f. 1 Hour Construction: UL System F-C-2041; RectorSeal FS 1900 Sealant, Metacaulk MC 150+, FSD Devise.
g. 1 Hour Construction: UL System F-C-2091; RectorSeal FS 1900 Sealant, Metacaulk MC 1000.
h. 1 Hour Construction: UL System F-C-2020; STI SpecSeal SSS Sealant, LCI Sealant, Firestop collar, LCC Firestop collar.
i. 1 Hour Construction: UL System F-C-2158; STI SpecSeal RED Wrap Strip, RED2, BLU Wrap Strip, BLU2 Wrap Strip, SpecSeal Firestop collar, LCC collar.

2.06 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
1. Fire Ratings: Use any system that is listed by UL (FRD) and tested in accordance with ASTM E814 with F Rating equal to fire rating of penetrated assembly and T Rating Equal to F Rating and in compliance with other specified requirements.
a. Systems penetrating a horizontal fire rated assembly, where contained and located within the cavity of a wall, do not require a T Rating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-sag gunnable joint sealants.

B. Joint backings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.

B. ASTM C834 - Standard Specification for Latex Sealants; 2014.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

E. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).

F. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
2. List of backing materials approved for use with the specific product.
3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.
6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
7. Sample product warranty.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Sustainable Design Documentation: For sealants and primers, submit VOC content and emissions documentation; see Section 01 61 16.

E. Executed warranty.

1.04 WARRANTY

A. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in vertical surfaces joints without sagging or slumping.

1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
2. Dow: www.dow.com.
3. GE Silicones Inc.: www.ge.com.
4. Pecora Corporation: www.pecora.com.
5. Sika Corporation: www.usa-sika.com.
6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
7. Or approved equal.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints:
      a. Seal open joints except open joints indicated on drawings as not sealed. Exterior joints to be sealed include, but are not limited to:
         1) Wall expansion and control joints.
         2) Joints between door, window, and other frames and adjacent construction.
         3) Joints between different exposed materials including, but not limited to:
            (a) Flashing and adjacent building materials.
            (b) Vertical siding/masonry joints.
            (c) Sleeves or pipes penetrating exterior walls.
            (d) Sleeves or pipes penetrating masonry or concrete walls.
         4) Openings below ledge angles in masonry.
         5) Lap joints in and penetrations through weather barriers.
         6) Exterior Siding:
         7) Other joints indicated below.
   2. Interior Joints:
      a. Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
         1) Joints between door, window, and other frames and adjacent construction.
         2) Gypsum board to wood or masonry.
         3) Metal to gypsum board, wood, or masonry.
         4) Perimeter of plumbing fixtures, shower surrounds, drains, or piping.
         5) Perimeter of counter tops and vanity tops
         6) Other joints indicated below.
   3. Framing: In addition to locations listed above or shown on the drawings to receive continuous sealant materials, a continuous bead of sealant, appropriate to construction materials and locations, shall be provided/installed at:
      a. Horizontal joint between bottom of wood sill plate and top of foundation wall or slab on grade.
      b. Horizontal joint(s) between double/triple top plates.
      c. Vertical joint(s) between double/triple studs in general framing and at door/window rough openings.
      d. Stud cavities blocked at change in ceiling heights.
      e. Penetrations through top and bottom plates.
      f. Seam(s) in band joists.
      g. Gaps in exterior wall sheathing.
      h. Penetrations in exterior wall sheathing.
      i. Penetrations in gypsum board of insulated exterior walls.
   4. Do Not Seal:
      a. Intentional weep holes in masonry.
      b. Joints indicated to be covered with expansion joint cover assemblies.
      c. Joints where sealant installation is specified in other sections.

B. Exterior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
   1. Masonry Expansion Joints: Two-part polyurethane.
   2. Metal to Masonry: Two-part polyurethane.
   3. Lap Joints in Sheet Metal Fabrications: Two-part polyurethane, non-curing.
   4. General Flashing and Flashing to Brick: One-part polyurethane.
   5. Sleeves in Walls: One-part polyurethane.

C. Interior Joints: Use non-sag acrylic sealant, unless otherwise indicated.
   1. Gypsum Board or Plaster to Masonry or Wood: Acrylic.
   2. Metal to Gypsum Board, Plaster or Masonry: Acrylic.
   3. Metal to Brick: Two-part polyurethane.
   4. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.04 NONSAG JOINT SEALANTS

A. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
   1. Color: White.
   2. Products:
      a. Dow Chemical Company; 732 Silicone: www.dow.com.
      b. GE Silicones, Inc; Silicone II: www.ge.com.
      c. Or approved equal.

B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Products:
      a. Pecora Corporation; Dynatrol, or GC-9 polysulfide: www.pecora.com/#sle.
      b. Tremco Commercial Sealants & Waterproofing; Dymonic 100: www.tremcosealants.com/#sle.

C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Products:
      a. Pecora Corporation; AC-20 Acrylic: www.pecora.com/#sle.
      b. Sherwin-Williams Company; 850A Acrylic Latex Caulk: www.sherwin-williams.com/#sle.
      c. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.

2.05 ACCESSORIES

A. Sealant Backing Rod, Open-Cell Type:
   1. Cylindrical flexible sealant backings complying with ASTM C1330 Type O.
   2. Size: 25 to 50 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 CLEANING

A. Remove excess sealant and caulking materials and smears from adjacent surfaces as work progresses.

B. Repair joints which have shrunk, sagged, run or have thin spots.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2015.

H. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

I. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

K. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.

L. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

M. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

N. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

O. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, gauges, reinforcements, cutouts, instaltion and anchorage details, and any indicated finish requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
   2. Fleming Door Products, an Assa Abloy Group company: www.assaabloydss.com.
   3. Republic Doors, an Allegion brand: www.republicdoor.com.
   4. Steelcraft, an Allegion brand: www.allegion.com.
   5. Or approved equal.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
   4. Door Edge Profile: Manufacturers standard for application indicated.
   5. Typical Door Face Sheets: Flush. Refer to Door Schedule for additional information.
   6. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
      a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Stair Tower & Corridor, Exterior Egress Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Door Edge: Model 1 - Full Flush Seam.
      d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
   3. Door Thermal Resistance: R-Value of 7.0.
   4. Door Thickness: 1-3/4 inches, nominal.
   5. Door Finish: Factory primed and field finished.

B. Stair Tower Access, Fire-Rated Doors:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Door Edge: Model 1 - Full Flush.
      d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Fire Rating: 1-1/2 hours, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").

3. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
4. Provide units listed and labeled by UL (DIR).
    a. Attach fire rating label to each fire rated unit.
5. Smoke and Draft Control Doors: Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following;
    a. Maximum Air Leakage: 3.0 cfm/sq ft of door opening at 0.10 inch w.g. pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
    b. Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
    c. Label: Include the "S" label on fire-rating label of door.
6. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
7. Door Thickness: 1-3/4 inches, nominal.
8. Door Finish: Factory primed and field finished.

C. Building Separation, Fire-Rated Doors:
1. Fire Rating: 1-1/2 hours, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
2. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
3. Provide units listed and labeled by UL (DIR).
    a. Attach fire rating label to each fire rated unit.
4. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
5. Door Thickness: 1-3/4 inches, nominal.
6. Door Finish: Factory primed and field finished.

D. Laundry Room, Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 1 - Standard-duty.
    b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Door Edge: Model 1 - Full Flush.
    d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
    e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Fire Rating: 3/4 hour, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
4. Provide units listed and labeled by UL (DIR).
    a. Attach fire rating label to each fire rated unit.
5. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
6. Door Thickness: 1-3/4 inches, nominal.
7. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
3. Frame Finish: Factory primed and field finished.
4. Weatherstripping: Separate, see Section 08 71 00.

C. Interior Door Frames, Non-Fire Rated: Knock-down type.

D. Door Frames, Fire-Rated: Knock-down type.

1. Fire Rating: Same as door, labeled.
2. Provide bi-directional frames at corridor Building Separation doors.
3. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
4. Frame Finish: Factory primed and field finished.

E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Glazing: Fire-rated safty glazing, factory installed.

B. Removable Stops: Formed sheet steel, mitered or butted corners; prepared for countersink style tamper proof screws.

C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Install door hardware as specified in Section 08 71 00.

E. Coordinate installation of electrical connections to electrical hardware items.

3.03 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08 11 16

ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazed aluminum doors.

B. Aluminum frames.

C. Glazing.

1.02 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

H. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each type of door; include information on installation and maintenance instructions.

C. Shop Drawings: Include elevations of each opening type.
   1. Verify dimensions by field measurements before fabrication and indicate on shop drawings.

D. Test Report: Certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver aluminum components in manufacturer's standard protective packaging, palleted, crated, or banded together.

B. Inspect delivered components for damage and replace. Repaired components will not be accepted.

C. Store components in clean, dry, indoor area, under cover in manufacturer's packaging until installation.

D. Protect materials and finish from damage during handling and installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glazed Aluminum Doors and Frames:
   1. Tubelite Inc; Standard Medium Stile: www.tubliteusa.com
   2. Wilson Partitions; Medium Stile/ Series 2400: www.wilsonpart.com.

2.02 DOORS AND FRAMES

A. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Glazed Aluminum Doors: Extruded aluminum tube frame, full glazed, without middle rail; factory glazed.
   1. Thickness: Manufacturer's standard for door size and construction.
   2. Stile Width: 4 inches, nominal.
   3. Bottom Rail Height: 10 inch, nominal.
   4. Finish: Class II - Color anodized.
   5. Texture: Smooth.
   6. Seals: Manufacturer's standard.
   7. Glazing, Exterior Doors: Sealed insulating units, 1 inch thick, made of clear 1/4 inch thick fully tempered glass.
   8. Manufacturer's Door Hardware: Manufacturer's standard.
      a. Hanging Devices: Butt hinges.
         1) Single Door Swing Direction: Swing out.
      b. Securing Devices: As required for project applications.
         1) Refer to Section 08 71 00 - Door Hardware.

C. Aluminum Frames for Doors, Sidelights, or Transoms: Extruded aluminum, thermally broken hollow or C-shaped sections; no steel components.
   1. Frame Depth: To fit wall thicknesses as indicated on drawings.
   2. Finish: Same as doors.
   3. Weatherstripping: Replaceable pile type; at jambs and head.
   4. Sidelight/Transom Glazing: Sealed insulating glass units, 1 inch overall thickness, with two panes of clear 1/4 inch thick fully tempered glass.

D. Dimensions and Shapes: As indicated on drawings; dimensions indicated are nominal.
   1. Provide the following clearances:
      a. Hinge and Lock Stiles: 1/8 inch.
      b. Between Meeting Stiles: 1/4 inch.
      c. At Top Rail and Bottom Rail: 1/8 inch.

2.03 COMPONENTS

A. Frames: Extruded aluminum shapes, not less than 0.062 inch thick, reinforced at hinge and strike locations.
   1. Corner Brackets: Extruded aluminum, fastened with stainless steel screws.
   2. Trim: Extruded aluminum, not less than 0.062 inch thick, removable snap-in type without exposed fasteners.

2.04 PERFORMANCE REQUIREMENTS

A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.

B. Air Leakage: Maximum of 0.1 cu ft/min/sq ft at 6.27 psf differential pressure, when tested in accordance with ASTM E283/E283M.

C. Overall U-value, Including Glazing: 0.35, minimum, measured on exterior door size required for this project.

2.05 MATERIALS

A. Aluminum Sheet: ASTM B209/B209M, alloy 5005, temper H14, stretcher leveled.

B. Extruded Aluminum: ASTM B221 (ASTM B221M), alloy 6063, temper T5, or alloy 6463, temper T5.

2.06 FINISHES

A. Class II Color Anodized Finish: Electrolytically deposited colored anodic coating; AAMA 611 AA-M12C22A34, minimum dry film thickness (DFT) of 0.4 mil, 0.0004 inch.

B. Color: As indicated on drawings.

2.07 ACCESSORIES

A. Fasteners: Aluminum, non-magnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components.

B. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, non-magnetic stainless steel or steel hot-dip galvanized in compliance with ASTM A123/A123M.

C. Bituminous Coating: Cold-applied asphaltic mastic, compounded for 30-mil thickness per coat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces and openings are ready to receive frames and are within tolerances specified in manufacturer's instructions.

3.02 PREPARATION

A. Perform cutting, fitting, forming, drilling, and grinding of frames as required for project conditions.

B. Replace components with damage to exposed finishes.

C. Separate dissimilar metals to prevent electrolytic action between metals.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and approved shop drawings.

B. Set frames plumb, square, level, and aligned to receive doors. Anchor frames to adjacent construction in strict accordance with manufacturer's recommendations and within specified tolerances.

C. Where aluminum surfaces contact metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by painting dissimilar metal with heavy coating of bituminous paint.

D. Hang doors and adjust hardware to achieve specified clearances and proper door operation.

3.04 CLEANING

A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance with AAMA 609 & 610.

B. Do not use abrasive, caustic, or acid cleaning agents.

3.05 PROTECTION

A. Protect products of this section from damage caused by subsequent construction until Date of Substantial Completion.

B. Replace damaged or defective components that cannot be repaired to a condition indistinguishable from undamaged components.

END OF SECTION

SECTION 08 11 30

RESIDENTIAL FIBERGLASS DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulated fiberglass entry doors and wood frames.
   1. Raised in-fill panels.

B. Insulated fiberglass French patio door and frames.

1.02 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.

B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

C. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

D. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

E. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

F. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference; 2000 (Reapproved 2016).

G. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007 (Reapproved 2016).

H. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2014.

I. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

J. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.

K. NFRC 400 - Procedure for Determining Fenestration Product Air Leakage.

L. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate door skin material and thickness, core materials and construction, and installation procedures.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
   1. Include conformance and testing data for Fire-Rated doors.

D. Performance Validation: Submit certified label or test report on products as indicated under performance requirements to validate product compliance.

E. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging. Do not store in damp or wet areas, or in areas of direct sunlight.

1.06 WARRANTY

A. Provide manufacturer's standard limited warranty for 25 years.
   1. Include coverage for warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Exterior Insulated Fiberglass Entry Doors:
   1. Therma Tru; Fiber-Classic Series; Mahogany Collection: www.thermatru.com.
   2. Bayer Built Inc; Designer Series; 3-Panel BFI: www.bayerbuilt.com.
   3. Substitutions: Or Approved Equal

2.02 COMPONENTS

A. Fiberglass Entry Doors: Insulated fiberglass-skin door entry systems; prehung in wood frames.
   1. Style: As indicated on drawings.
   2. Thickness: 1-3/4 inches, unless otherwise indicated.
   3. Exterior Skin: 1/16 inch minimum, fiberglass reinforced thermoset composite.
   4. Interior Frame: Kiln-dried pine or engineered lumber; door bottom edge: moisture/decay resistant composite.
   5. Core: Foamed-in-place, CFC-free, polyurethane foam bonded to exterior skin; density 1.9 pcf minimum.
   6. Reinforcement: Solid wood blocking in full area of passage and deadbolt locksets.
      a. Provide continuous blocking for top 8 inches of door for installation of automatic closer devise where scheduled.
   7. Finish: Factory primed; ready for field painting.

B. Configurations:
   1. Dwelling Unit Patio/ Balcony Doors:
      a. Configuration: Single door.
      b. Style: Single-French, Full-glazed
      c. Glazing: Tempered, Insulated.
   2. Dwelling Unit Exterior Storage Closet Doors:
      a. Configuration: Single door.
      b. Style: Embossed Panel; 3-panel crafstman

C. Frames: Manufacturer's standard rot-resistant composite frame, for field finishing.
   1. Frame: Laminated Veneer Lumber (LVL) core wrapped in UV-stabilized composite outer layer; profiled 1/2 inch stops with gasket kerf.
   2. Frame Depth: 4-9/16 inch, minimum.
   3. Gaskets: Factory installed Jacketed thermoset closed-cell foam, press-fit in kerfs at jamb stops in frames.
   4. Hardware preparation: Frames shall be mortised, reinforced, drilled and tapped at the factory to receive hardware as specified in the hardware schedule.
   5. Install frame reinforcing plate to strike side.

D. Thresholds: Low profile complying with ANSI Accessibility requirements. Refer to Section 08 71 00 - Door Hardware
   1. Inswing: Aluminum with Thermal Break.
   2. Outswing: Aluminum with Thermal Break.
      a. Outswing threshold may have a 1/4 inch vertical rise (against which door swings) and a 1/4 inch sloping rise (1:2 max. slope), with a total height of 1/2 inch maximum.
   3. Finish: Mill finish.

E. Glazing: Double glazed, clear, Low-E coated, argon gas filled, fully tempered, with glass thicknesses as recommended by manufacturer for specified wind conditions.
   1. Fully Tempered Glass: ASTM C1048, Kind FT - Fully Tempered.
   2. Outboard Lite: Clear glass.

3. Inboard Lite: Clear glass.
4. Air Space: 1/4 inch.
5. Apply protective polyolefin removable film to No. 1 and No. 4 insulating glass surfaces.

F. Glazing Stops: Aluminum channel shape, mitered corners; prepared for countersink style screws.
1. Apply silicone glazing sealant to exterior glazing stops as recommended by manufacturer.

G. Weatherstripping: Jacketed thermoset closed-cell foam, press-fit in kerfs at jamb stops in frames.

H. Door Sweeps: Extruded thermoplastic elastomer, finned and chambered design, press-fit into bottom edge of doors.

I. Door Hardware: As specified in Section 08 71 00.

2.03 PERFORMANCE REQUIREMENTS

A. Water Penetration Resistance: No uncontrolled leakage on interior face when tested in accordance with ASTM E547 at differential pressure of 15 percent of Performance Grade (PG).

B. Air Leakage: Maximum of 0.30 cu ft/minute/sq ft at 1.57 psf differential pressure, when tested in accordance with ASTM E283.

C. Thermal Transmittance: U-factor of 0.25, maximum, that includes window glazing, door and frame system based on average window size required for project and determined in accordance with NFRC 100.

D. Forced Entry Resistance (FER): Tested to comply with ASTM F476 requirements having at least Grade 10 performance for each required swinging door assembly.

2.04 FABRICATION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores constructed with stiles and rails:
1. Provide solid blocks at lock edge for hardware reinforcement.
2. Provide solid blocking for other thru-bolted hardware where scheduled.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

2.05 FINISHES

A. Color: To be selected by Owner from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Install exterior doors in accordance with ASTM E2112.
1. Thresholds shall be installed and sealed securely, level and without discernable movement, to underlayment below.

C. Assemble multiple units before installation in accordance with manufacturer’s installation guidelines.

D. Use machine tools to cut or drill for hardware.

E. Coordinate installation with seal of perimeter air and vapor barrier materials as specified in Section 07 25 00.

F. Coordinate installation of doors with installation of integral frames and hardware.

G. Coordinate installation of glazing.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 CLEANING

A. Remove protective material from factory finished surfaces.

B. Clean units using cleaning material and methods in accordance with door manufacturer's written recommendations.

3.06 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site.

B. Protect unit surfaces from masonry cleaning solution that could damage insulating glass panels, aluminum or wood finishing, and hardware.

END OF SECTION

SECTION 08 14 16

WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Molded Panel doors; solid core; fire-rated and non-rated.

B. Pre-hung Molded Panel doors; hollow core.

1.02 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

C. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

D. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory priming, and other details.

D. Manufacturer's Installation Instructions: Indicate special installation instructions.

E. Warranty, executed in Owner's name.

1.04 QUALITY ASSURANCE

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.06 WARRANTY

A. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.

1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Molded Panel Doors

1. Masonite International Corp.: www.masonite.com.
2. Baird Brothers Sawmill Inc.: www.bairdbrothers.com.
3. Jeld-Wen Inc.: www.jeldwen.com.
4. Or approved Equal.

2.02 DOORS

A. Doors: Refer to drawings for locations and additional requirements.

1. Quality Standard: Economy Grade, Standard Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Interior Doors: 1-3/8 inches thick unless otherwise indicated; molded panel construction.

1. Style: 3-Panel Crafstman as indicated on drawings.
2. Provide solid core door at each fire-rated opening.
3. Fire Rated Doors: Tested to 20 minutes in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) labeled without any visible seals when door is closed.

4. Hardboard facing for field opaque finish.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Hollow Core Doors: Type - Standard (FSHC); plies and faces as indicated above.

2.04 DOOR FACINGS

A. Hardboard Facing for Opaque Finish: ANSI A135.4, Class 2 - Standard, Molded Panel hardboard, 1/8 inch thick.

B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with wood stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
   1. Mortice doors for 3-1/2 inch standard duty radius hinges.
   2. Face bore(s) for cylindrical lock, where scheduled, are to be 2-1/8” diameter at 2-3/8 inch backset.

D. Vertical door edges to be beveled lock strike side and meeting rails.

E. Factory fit and hang doors to frames constructed for the opening dimensions identified on the Drawings, with edge clearances in accordance with specified quality standard.
   1. Provide 3/8 inch clearance at bottom unless additional cut-off is indicated.

2.06 FRAMES

A. Jambs: Wood jambs shall be fabricated as a flat jamb with applied stops, or a one piece jamb with milled stops, solid or finger-jointed white pine. Factory primed, white.

B. Hinges: Mortise jamb for 3-1/2 inch, standard duty radius hinges.
   1. 3 standard weight radius mortise hinges are required on doors 7’0” height or smaller.

C. Strike: Jamb to be machined for a full lip cylindrical strike plate.
   1. Double door units shall include preparations for ball catch located at the top of door on both door panels designed to strike into the head jamb.

2.07 FINISHES

A. Factory prime door faces, stiles, and rails with manufacturer's standard water based latex primer; white.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Use machine tools to cut or drill for hardware.

C. Coordinate installation of doors with installation of frames and hardware.

END OF SECTION

SECTION 08 53 13
VINYL WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vinyl-framed, factory-glazed windows.

B. Operating hardware.

C. Insect screens.

1.02 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.

B. AAMA 701/702 - Combined Voluntary Specifications for Pile Weatherstrip and Replaceable Fenestration Weatherseals; 2011.

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

D. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

E. ASTM E1423 - Standard Practice for Determining the Steady State Thermal Transmittance of Fenestration Systems; 2014.

F. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007 (Reapproved 2016).

G. ASTM F2090-13 - Standard Specification for Window Fall Prevention Devices With Emergency Escape (Egress) Release Mechanisms; 2013.

H. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2014.

I. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, anchors, fasteners, glass, and internal drainage.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, and installation requirements.

D. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.

E. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

F. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

G. Egress Units Compliance: Certify that bedroom window unit's net opening size and dimensions meet or exceed current minimum code requirements for use as a means of emergency egress.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and after installation of sealants.

1.07 WARRANTY

A. Manufacturer's Warranty: Provide five-year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of vinyl color finish. Complete form in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Vinyl Windows:
   1. Alside, Inc; Series 1700: www.alside.com.
   2. All Temp Windows Inc.; Series 1800: www.alltempwindows.com
   3. Jeld-Wen Inc.; Builders Vinyl Series: www.jeldwen.com.
   4. Milgard Manufacturing; StyleLine Series: www.milgard.com.
   5. Alliance Window Systems; Windgate Series: www.alliancewindows.com

2.02 DESCRIPTION

A. Vinyl Windows: Factory-fabricated frame and sash members of extruded, hollow, ultra-violet-resistant, polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.
   1. Configuration: As indicated on drawings.
      a. Product Type: H - Hung window, vertically sliding; Single Hung in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
      b. Egress Units: Window units installed in dwelling unit bedrooms shall meet or exceed minimum requirements for classification as emergency egress units per the currently adopted edition of the building code.
   2. Color: White.
   3. Exterior Color: White.
   4. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.
   5. Operable Units: Double weatherstripped.
   6. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.
   7. System Internal Drainage: Drain to exterior side by means of weep drainage network any water entering joints, condensation within glazing channel, or other migrating moisture within system.
   8. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.
   9. Mounting Flange: Integral to frame assembly, providing weather stop at entire perimeter of frame.
   10. Insect Screens: Tight fitting for operating sash location.

B. Energy Star Rating: Provide windows eligible for Energy Star Rating.

2.03 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
   1. Performance Class (PC): R.
   2. Performance Grade (PG): 15, with minimum design pressure (DP) of 15.04 psf.

B. Air Leakage: Maximum of 0.30 cu ft/minute/sq ft at 1.57 psf differential pressure, when tested in accordance with ASTM E283.

C. Thermal Transmittance: Refer to drawings. U-factor to include window glazing and frame system based on average window size required for project and determined in accordance with AAMA 1503, ASTM E1423, or NFRC 100.

D. Solar Heat Gain Coefficient (SHGC): Refer to drawings.

E. Visible Light Transmittance: value of 0.52 minimum.

F. Forced Entry Resistance (FER): Tested to comply with ASTM F588 requirements having at least Grade 10 performance for each required window assembly.

2.04 COMPONENTS

A. Glazing: Insulated double pane, annealed glass, clear, low-E coated, argon filled, with glass thicknesses as recommended by manufacturer for specified wind conditions.
   1. Provide tempered glass where required by Code for hazardous locations.
   2. Glass Stops: Snap-on PVC glazing bead with color to match sash and frame.

B. Frame Depth: 3-1/4 inch minimum.

C. Simulated Divided Lite Grid: Installed between panes of insulating glass, 5/8 inch wide flat metal bars, color to match frame and sash.
   1. Pattern: Prairie Grille.

D. Insect Screens: Aluminum, extruded or roll-formed frame with mitered and reinforced corners; apply screen mesh taut to frame; secure to window with hardware to allow easy removal.
   1. Hardware: Manufacturer's standard; quantity as required per screen.
   2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's standard mesh.
   3. Frame Finish: Manufacturer's standard, color to match window frame and sash color.

E. Operable Sash Weatherstripping: High density polypropylene pile; permanently resilient, profiled to maintain weather seal in accordance with AAMA 701/702.

F. Fasteners: Galvanized steel.

G. Accessories: Provide related flashings, anchorage and attachment devices as necessary for full assembly.

H. Glazing Sealant: Manufacturer's standard, tested, sealant; factory installed.

I. Sealants for Setting Window Sill Pan Flashing: Provide silicone sealant; in compliance with ASTM E2112 installation practices.

2.05 HARDWARE

A. Vertical Sliding Sash: Metal and nylon spiral friction slide cylinder, provide two for each sash and jamb.

B. Sash lock: Lever handle and keeper with cam lock, provide at least one for each operating sash.

C. Window Opening Control Devices: ASTM F2090-13 opening control devices that limit opening size to less than 4 inches maximum with release function to permit window to open fully.
   1. Required for all Dwelling Unit operable windows when sill is less than 36 inches above finish floor, and window unit is located greater than 72 inches above finish grade.

D. Finish of Exposed Hardware: Baked enamel, match interior sash and frame color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining water-resistive air barrier seal materials are ready to receive this work.

3.02 INSTALLATION

A. Install window unit assemblies in accordance with manufacturers instructions and applicable building codes.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities as necessary.

C. Provide continuous shim support along full length of sill.

D. Align window plumb and level, free of warp or twist, and maintain dimensional tolerances and alignment with adjacent work.

E. Set sill members and sill flashing in continuous bead of sealant.

F. Provide thermal continuity of the building envelope. Fill shim spaces at perimeter of assembly with gap-filling foam specified in Section 07 21 00 - Thermal Insulation.

3.03 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.04 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer and appropriate for application indicated.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for hollow metal, aluminum, residential steel, and wood doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Thresholds.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. BHMA A156.1 - American National Standard for Butts and Hinges; 2013.

C. BHMA A156.3 - American National Standard for Exit Devices; 2014.

D. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.

E. BHMA A156.7 - American National Standard for Template Hinge Dimensions; 2014.

F. BHMA A156.15 - American National Standard for Release Devices - Closer Holder, Electromagnetic and Electromechanical; 2011.

G. BHMA A156.16 - American National Standard for Auxiliary Hardware; 2013.

H. BHMA A156.17 - American National Standard for Self Closing Hinges & Pivots; 2014.

I. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.

J. BHMA A156.21 - American National Standard for Thresholds; 2014.

K. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012.

L. BHMA A156.28 - American National Standard for Recommended Practices for Mechanical Keying Systems; 2013.

M. BHMA A156.31 - American National Standard for Electric Strikes and Frame Mounted Actuators; 2013.

N. BHMA A156.36 - American National Standard for Auxiliary Locks; 2014.

O. DHI (KSN) - Keying Systems and Nomenclature; 1989.

P. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

Q. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

S. UFAS - Uniform Federal Accessibility Standards - HUD 24 CFR part 40; 1984.

T. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

D. Specimen warranty.

E. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. Lock Cylinders: One for each master keyed group.
   2. Leversets and Dead Latches: One for each type specified.
   3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.06 WARRANTY

A. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
   1. Closers: Five years, minimum.
   2. Exit Devices: Three years, minimum.
   3. Locksets and Cylinders: Three years, minimum.
   4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: UFAS, ADA Standards, and ICC A117.1.
   3. Auxiliary Hardware: BHMA A156.16.
   4. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
   1. See Section 28 10 00 for additional access control system requirements.

E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule at end of this section.

F. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      a. Aluminum fasteners are not permitted.
      b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   2. Fire-Rated Applications: Comply with NFPA 80.
      a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
      b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 HINGES

A. Manufacturers:
   1. McKinney; an Assa Abloy Group company: www.assaabloydss.com.
   2. Hager Companies: www.hagerco.com.
   3. Pamex, Inc; Hinges: www.pamexinc.com.
   4. Best, dormakaba Group (formerly Stanley): www.bestaccess.com.
   5. Stanley Manufacturing Co.: www.stanleyhardware.com.

B. Hinges: Comply with BHMA A156.1, Grade 3.
   1. Self Closing Hinges: Comply with BHMA A156.17.
   2. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
      a. Provide hinge width required to clear surrounding trim.

3. Provide hinges on every swinging door.
4. Provide self-closing spring hinges on dwelling unit entry doors.
5. Provide ball-bearing hinges at each door with closer.
6. Provide non-removable pins on exterior outswinging doors.
7. Provide following quantity of butt hinges for each door:
    a. Doors From 60 inches High up to 90 inches High: Three hinges.
    b. Doors 90 inches High up to 120 inches High: Four hinges.

2.03 EXIT DEVICES

A. Manufacturers:
1. Best, dormakaba Group (formerly Stanley): www.bestaccess.com.
2. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company: www.assaabloydss.com.
3. Hager Companies: www.hagerco.com.
4. Pamex, Inc; Exit Devices: www.pamexinc.com.
5. Von Duprin, an Allegion brand: www.allegion.com/us.

B. Exit Devices: Comply with BHMA A156.3, Grade 3.
1. Lever design to match lockset trim.
2. Provide cylinder with cylinder dogging or locking trim.
3. Provide exit devices properly sized for door width and height.
4. Provide strike as recommended by manufacturer for application indicated.
5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.
6. For electrical options, provide quick connect plug-in pre-wired connectors.

2.04 ELECTRIC STRIKES

A. Manufacturers:
1. Adams Rite or Securitron; an Assa Abloy Group company: www.assaabloydss.com.
2. Pamex, Inc; Electric Strikes: www.pamexinc.com.

B. Electric Strikes: Comply with BHMA A156.31, Grade 1.
1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
2. Provide non-handed 24 VDC electric strike suitable for door frame material and scheduled lock configuration.
3. Provide field selectable Fail Safe/Fail Secure modes.
4. Provide transformer and rectifier as necessary for complete installation.

2.05 CYLINDRICAL LOCKS

A. Manufacturers:
1. Basis of Design: Schlage 'Elan'.
2. Sargent or Yale; an Assa Abloy Group company: www.assaabloydss.com.
3. Best, dormakaba Group (formerly Stanley): www.bestaccess.com.
4. Hager Companies: www.hagerco.com.
5. Schlage, an Allegion brand: www.allegion.com/us.

B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 3.
1. Bored Hole: 2-1/8 inch diameter.
2. Latchbolt Throw: 1/2 inch, minimum.
3. Backset: 2-3/4 inch unless otherwise indicated.
4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
    a. Finish: To match lock or latch.
    b. Extra-Long-Lip Strikes: Provide for locks used on frames with applied wood casing trim.
5. Provide a lock for each door, unless otherwise indicated that lock is not required.
6. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.

2.06 AUXILIARY LOCKS (DEADLOCKS)

A. Manufacturers:
1. Basis of Design: Schlage 'B60' & 'B680'.

2. Yale; an Assa Abloy Group company: www.assaabloydss.com.
3. Best, dormakaba Group (formerly Stanley): www.bestaccess.com.
4. Hager Companies: www.hagerco.com.
5. Schlage, an Allegion brand: www.allegion.com/us.

B. Auxiliary Locks (Deadlocks): Comply with BHMA A156.36, Grade 3.
1. Type: Bored (cylindrical).
2. Backset: 2-3/4 inch, unless otherwise indicated.
3. Bolt Throw: 1 inch, with latch made of hardened steel.
4. Provide strike that matches frame.

2.07 CLOSERS

A. Manufacturers; Surface Mounted:
1. Basis of Design: Falcon SC93/94; Jamb top.
2. Sargent, Yale, or AdamsRite; an Assa Abloy Group company: www.assaabloydss.com.
3. Best, dormakaba Group (formerly Stanley): www.bestaccess.com.
4. Hager Companies: www.hagerco.com.
5. Falcon or LCN, an Allegion brand: www.allegion.com/us.

B. Closers: Comply with BHMA A156.4, Grade 3.
1. Type: Surface mounted to door.
2. Provide door closer on each exterior door of the Community Building.
3. At outswinging exterior doors, mount closer on interior side of door.
4. Provide adapter plate where required.

2.08 ELECTROMAGNETIC DOOR HOLDERS

A. Manufacturers:
1. Sargent; an Assa Abloy Group company: www.assaabloydss.com.
2. DORMA USA, Inc; EM Series: www.dorma.com.
3. Pamex, Inc; Electromagnetic Door Holders: www.pamexinc.com.

B. Electromagnetic Door Holders: Comply with BHMA A156.15.
1. Type: Wall mounted, single unit, standard duty, with strike plate attached to door.
2. Holding Force, Standard Duty: 40 lbs-force, minimum.
3. Voltage: 12 VDC, and provide power supplies by same manufacturer as holders.
4. Fail safe; door released to close automatically when electrical current is interrupted.
5. Provide interface with fire detectors and fire-alarm system for fire-rated door assemblies.

2.09 WALL STOPS

A. Manufacturers:
1. Basis of Design: Trimco 1270 Series.
2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
3. Hager Companies: www.hagerco.com.
4. Hiawatha, Inc, division of Activar Construction Products Group, Inc: www.activarcpg.com/hiawatha.
5. Trimco: www.trimcohardware.com.

B. Wall Stops: Comply with BHMA A156.16, Grade 3 and Resilient Material Retention Test as described in this standard.
1. Provide wall stops to prevent damage to wall surface upon opening door.
2. Type: Flexible stem wall stop.
3. Material: Stainless steel spring with vinyl cap.

2.10 ASTRAGALS

A. Manufacturers:
1. Pemko; an Assa Abloy Group company: www.assaabloydss.com.
2. Hager Companies: www.hagerco.com.
3. National Guard Products, Inc: www.ngpinc.com.

B. Astragals: Comply with BHMA A156.22.
1. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
2. Type: Split, two parts, and with sealing gasket.

3. Material: Aluminum, with neoprene smoke gaskets.
4. Provide non-corroding fasteners at exterior locations.

2.11 THRESHOLDS

A. Manufacturers:
1. Pemko; an Assa Abloy Group company: www.assaabloydss.com.
2. Hager Companies: www.hagerco.com.
3. National Guard Products, Inc: www.ngpinc.com.

B. Thresholds: Comply with BHMA A156.21.
1. Provide threshold at each exterior door, unless otherwise indicated.
2. Type: Low Profile.
   a. Thresholds at outswing exterior doors may be rabbeted with door stop type; 1/4 inch vertical rise, 1/2 inch total height; maximum 1:2 bevel.
3. Material: Aluminum.
4. Threshold Surface: Thermally broken.
5. Field cut threshold to profile of frame and width of door sill for tight fit.
6. Provide non-corroding fasteners at exterior locations.

2.12 BALL CATCH

A. Manufacturers:
1. Basis of Design: Ives 347.
2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
3. Ives, an Allegion brand: www.allegion.com/us.

B. Ball Catch: Provide on doors not provided with latchsets that must stay in closed position within the frame.
1. Location: Mount ball catch at top of door with strike plate fastened to head of door frame.
2. Material: Brass.

2.13 VIEWER

A. Manufacturers:
1. Basis of Design: Ives U698.
2. Ives, an Allegion brand: www.allegion.com/us.
3. Prime-Line Inc: www.primeline.net
4. Gatehouse Inc.: www.lowes.com

B. Viewer: Provide at inside of door at eye level to see who is on outside of door.
1. Material: Stainless steel.
2. Size: 1/2 inch diameter mounting hole.
3. View: 190 degree field of view.
4. Finish: Brushed nickel.

2.14 KEY CONTROL SYSTEMS

A. Key Control Systems: Comply with guidelines of BHMA A156.28.
1. Provide keying information in compliance with DHI (KSN) standards.
2. Keying: All locks Master keyed.
   a. Dwelling Units: All exterior doors keyed alike.
   b. Community Building: All exterior doors keyed alike.
3. Supply keys in following quantities:
   a. 4 each Master keys.
   b. 2 each Keys for each keyed core.

2.15 FIRE DEPARTMENT LOCK BOX

A. Manufacturers:
1. Knox Company; Knox-Box Rapid Entry System, 3200: www.knoxbox.com.

B. Fire Department Lock Box:
1. Heavy-duty, surface mounted, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers.
2. Capacity: Holds 10 keys.
3. Finish: Manufacturer's standard silver.

2.16 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
   1. Primary Finish: 619; satin nickel plated, clear coated, with brass or bronze base material; BHMA A156.18.
   2. Exceptions:
      a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
      b. Hinges for Fire-Rated Doors: Steel base material with painted finish, in compliance with NFPA 80.
      c. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
      d. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish, not other hardware, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

C. Use templates provided by hardware item manufacturer.

D. Do not install surface mounted items until application of finishes to substrate are fully completed.

E. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list, unless noted otherwise on drawings.
   1. Mounting heights in compliance with ANSI, UFAS, or ADA Standards, where applicable:
      a. Locksets: 36 inch.
      b. Deadlocks (Deadbolts): 41-1/2 inch.
      c. Door Viewer: accessible unit height 42 inch; typical unit height 60 inch.

F. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 ADJUSTING

A. Adjust hardware for smooth operation.

B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

A. Do not permit adjacent work to damage hardware or finish.

PART 4 SCHEDULES - SEE NEXT PAGE

4.01 HARDWARE SETS

A. Group No 01: Building - Main Paired Entry Door .
   1. EA = Each. EL = Each Leaf.

2	EL	Hinges - 3-1/2 inch x 3-1/2 inch
1	EL	Power Transfer Hinges - 3-1/2 inch x 3-1/2 inch
1	EL	Powered-release Exit Device w/ outside locking lever trimset
1	EL	Head and floor rods; concealed
1	EA	Push plate button - interior
1	EA	Power Door Operator
1	EA	Push plate button - exterior
1	EA	Proximety Reader - exterior
1	EA	Accessible Threshold

B. Group No 02: Building - Corridor Egress Doors.
   1. For use at 1st Floor West and East Egress Doors.

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Exit Device w/ outside locking lever trimset
1	EA	Electric Strike
1	EA	Proximety Reader - exterior
1	EA	Closer
1	EA	Accessible Threshold

C. Group No 03: Building - Stair Tower Exterior Egress Doors.
   1. For use at 1st Floor West and East Stair Tower Egress Doors.

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Exit Device w/ outside locking lever trimset
1	EA	Closer
1	EA	Accessible Threshold

D. Group No 04: Building - Stair Tower Access Doors - 90 Min Fire-rated.
   1. Provide Fire-Rated hardware.

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Exit Device w/ lever trimset
1	EA	Closer

E. Group No 05: Building - Sprinkler Room Entry Door

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Dead Latch; single cylinder w/ thumb turn
1	EA	Locking Leverset
1	EA	Chain Keeper
1	EA	Threshold

F. Group No 06: Building Common Area - Building Separation Fire Doors - 90 Min Fire-rated
   1. Provide Bi-Directional door frame for egress in either direction.
   2. Provide Fire-Rated hardware for each leaf.

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Electro-Mag Hold Open
1	EA	Exit Device w/ lever trimset
1	Set	Astragal and floor sweep
1	EA	Closer

G. Group No 07: Building Common Area - Secure Interior Doors - 20 Min Fire-rated.
   1. Provide Fire-rated hardware.
   2. At Office: Provide Dead Latch; single cylinder w/ thumb turn in addition.

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Locking Leverset
1	EA	Closer

H. Group No 08: Building Common Area - Toilet Room Doors - 20 Min Fire-rated.
   1. Provide Fire-rated hardware.

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Privacy Leverset w/ push-button latching
1	EA	Closer

I. Group No 09: Building Common Area - Tenant Laundry Room Doors - 45 Min Fire-rated.
   1. Provide Fire-Rated hardware.

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Passage Leverset
1	EA	Closer

J. Group No 10: Dwelling Unit - Entry Doors - 20 Min Fire-rated.
   1. Provide Fire-Rated hardware.

3	EA	Self-closing spring Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Dead latch - single cylinder w/ thumb turn
1	EA	Dead latch - half-bore with thumb turn (inside)
1	EA	Passage Leverset
1	EA	Viewer (peephole) (2 ea. at accessible dwelling units)
1	EA	Wall-mounted Stop

K. Group No 11: Dwelling Unit - Patio/ Balcony Doors.
   1. Provide accessible Thresholds at all 1st floor units.

3	EA	Security Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Dead latch - double cylinder
1	EA	Passage Leverset
1	EA	Wall-mounted Stop
1	EA	Threshold

L. Group No 12: Dwelling Unit - Exterior Storage Closet Door.
   1. Provide accessible Thresholds at all 1st floor units.
   2. Provide security hinges at all 1st floor units.

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Dead latch - single cylinder w/ thumb turn
1	EA	Passage Leverset
1	EA	Chain keeper
1	EA	Threshold

M. Group No 13: Dwelling Unit - Bedroom and Bath Doors

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Privacy Leverset w/ push-button latching
1	EA	Wall-mounted Stop

N. Group No 14: Dwelling Unit - Closet Double Swing Doors.
   1. Provide for each door in the pair.

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Dummy Leverset
1	EA	Ball Catch
1	EA	Wall-mounted Stop

O. Group No 15: Other Interior Doors.

3	EA	Hinges - 3-1/2 inch x 3-1/2 inch
1	EA	Passage Leverset
1	EA	Wall-mounted Stop

END OF SECTION

SECTION 08 71 13
POWER DOOR OPERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operators for swinging doors.

B. Controllers, actuators, and safety devices.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. BHMA A156.19 - American National Standard for Power Assist and Low Energy Power Operated Doors; 2013.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 101 - Life Safety Code; 2015.

F. UFAS - Uniform Federal Accessibility Standards - HUD 24 CFR part 40; 1984.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate power door operators with balance of door hardware and electrical work required for each affected door opening.
   1. Templates: Check other sections' shop drawings to confirm that adequate provisions are in place for locating and installing power door operators.
   2. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to power supplies, remote activation devices, and electric door latching hardware.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings:

C. Product Data: Provide data on system components, sizes, features, and finishes.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.

E. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Operators for Swinging Doors:
   1. Detex Corporation; AO19-2: www.detex.com.
   2. Stanley Access Technologies; Magic Access LE (Low Energy): www.stanleyaccess.com.
   3. Or approved equal.

2.02 POWER DOOR OPERATORS - GENERAL

A. Electrically Operated or Controlled Hardware: Provide necessary power supplies, relays, and interfaces as required for proper operation; provide wiring between control components and to building power connection in compliance with NFPA 70.

B. Comply with ADA Standards for egress requirements.

C. Comply with NFPA 101 and requirements of authorities having jurisdiction; provide units selected for actual door weight and for light pedestrian traffic unless otherwise indicated.

D. Exterior and Vestibule Doors: Provide equipment suitable for ambient operating temperature range of minus 20 to plus 140 degrees F.

E. Exterior Doors: Provide units capable of operating, closing, and holding doors closed under positive and negative differential pressure; if necessary, provide power closing.

2.03 OPERATORS FOR SWINGING DOORS

A. Door Operator: Electromechanical.
   1. Applications: Include operators for single doors.
   2. Electromechanical Operators: 1/4 hp minimum, self-contained, gear driven, with release clutch.
   3. Speed Control: Variable, field-adjustable opening and closing cycles.
   4. Functionality: Low-energy power open, power close operation.
      a. Low-Energy Power Operators: Comply with BHMA A156.19; operator activated by pushing or pulling the door or by manual actuator, not a sensor; safeties not required.
         1) Kinetic Energy of Door in Motion: 1.25 lbf ft, maximum.
         2) Force Required to Prevent Stopped Door From Opening or Closing: 15 lbf, maximum, measured at 1 inch from the latch edge of the door at any point in the swing cycle.
         3) Force Required to Release Latch When Unpowered: 15 lbf, maximum, measured at 1 inch from the latch edge of the door at any point in the swing cycle.
         4) Force Required to Set Door in Motion When Unpowered: 30 lbf, maximum, measured at 1 inch from the latch edge of the door at any point in the closing cycle.
         5) Force Required to Fully Open Door When Unpowered: 15 lbf, maximum, measured at 1 inch from the latch edge of the door at any point in the closing cycle.
   5. Mounting: Surface mounted overhead.
   6. Components:
      a. Header Case: Manufacturer's standard extruded aluminum profile containing door operator and door mounting components.
      b. Motor and Gearbox Assembly: Manufacturer's standard sealed motor, gearbox, and drive belt.
   7. Power Supply Units: Self-contained, electrically operated, and integrated with door operator.
   8. Actuators: Manufacturer's standard.
      a. Push-Side Actuator: Push plate; wall-mounted.
      b. Pull-Side Actuator: Push plate; wall-mounted; weatherproof enclosure.
   9. Hold Open: Toggle switch at inside head of doors.

2.04 CONTROLLERS, ACTUATORS, AND SAFETY DEVICES

A. Actuators: Manufacturer's standard for products specified and as specified below.
   1. Push Plate Actuator: Standard, wall mounted, surface mounted, momentary contact type; satin stainless steel plate; 4 inches diameter; labeled PUSH.
      a. Provide weather-proof enclosure at outside actuator.

2.05 FINISHES

A. Aluminum Finishes: Manufacturer's standard.
   1. Class II Natural Anodized Finish: Clear anodic coating; AAMA 611 AA-M12C22A31, minimum dry film thickness (DFT) of 0.4 mil, 0.0004 inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that electric power is available, in the correct location, and of the correct characteristics.

3.02 INSTALLATION

A. Coordinate installation of components with related and adjacent work.
   1. Interconnect power operator with access control.

B. Install equipment in accordance with manufacturer's instructions.

C. Mount actuators in compliance with ADA and UFAS regulations.

3.03 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

3.04 CLEANING

A. Remove temporary protection, clean exposed surfaces.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Gypsum wallboard.

C. Joint treatment and accessories.

D. Textured finish system.

1.02 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Framing - Nonstructural Members; 2015.

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015.

C. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

E. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2014).

F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

I. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

J. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014a.

K. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.

L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

M. GA-216 - Application and Finishing of Gypsum Board; 2013.

N. GA-600 - Fire Resistance Design Manual; 2015.

O. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

B. Fire-Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire-Rated Walls and Partitions: UL listed assembly No. U305; 1 hour rating.
   2. Fire-Rated Walls and Partitions: UL listed assembly No. U301; 2 hour rating.
   3. Fire-Rated Structural Column Framing: GA-600 File Number CM 1452; 1 hour rating.
   4. Fire-Rated Structural Beam Framing: GA-600 File Number BM 1137; 1 hour rating.
   5. Fire-Rated Shaft Walls: UL listed assembly No. U301; 2 hour rating.
   6. Fire-Rated Shaft Ceiling: Refer to IBC 722.6.2.
   7. Fire-Rated Exterior Walls: UL listed assembly No. U356; 1 hour rating
   8. Fire-Rated Floor/Ceiling Assemblies: UL listed assembly No. L550 & L516; 1 hour rating.
   9. Fire-Rated Roof/Ceiling Assemblies: UL listed assembly No. P556; 1 hour rating.

10. Fire-Rated Dwelling Unit Separation Walls: UL listed assembly No. U341; 1 hour rating as indicated on drawings.
11. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
12. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

B. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
   1. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Georgia-Pacific Gypsum: www.gpgypsum.com.
   4. National Gypsum Company: www.nationalgypsum.com.
   5. USG Corporation: www.usg.com.
   6. Or approved equal.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish of the same core type shall be used in tub/shower alcoves.
   3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold resistant board is required at all damp locations.
         1) Locations include:
            (a) Shower and tub walls and ceilings.
            (b) Back and side walls adjacent to Water Closet, to 48 inches above finished floor.
            (c) Back wall behind Lavatory, to 48 inches above finished floor.
            (d) Back wall behind Kitchen Sink and Dishwasher, to 48 inches above finished floor.
            (e) Back wall behind location designated for Laundry appliances, to 48 inches above finished floor.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch, or as indicated.
      b. Ceilings: 5/8 inch.
   5. Paper-Faced Products:
      a. American Gypsum Company; ClassicRoc Gypsum Wallboard.
      b. American Gypsum Company; FireBloc Type X Gypsum Wallboard.
      c. American Gypsum Company; FireBloc Type C Gypsum Wallboard.
      d. CertainTeed Corporation; Type C Drywall.
      e. CertainTeed Corporation; Type X Drywall.
      f. Georgia-Pacific Gypsum; ToughRock.
      g. Georgia-Pacific Gypsum; ToughRock Fireguard X.
      h. Georgia-Pacific Gypsum; ToughRock Fireguard C.
      i. National Gypsum Company; Gold Bond Brand Gypsum Wallboard.
      j. National Gypsum Company; Gold Bond Brand Fire-Shield Gypsum Board.
      k. USG Corporation; Sheetrock Brand Gypsum Wallboard.
      l. USG Corporation; Sheetrock Brand Firecode X.
   6. Mold-Resistant, Paper-Faced Products:
      a. American Gypsum Company; M-Bloc.
      b. American Gypsum Company; M-Bloc Type X.

c. American Gypsum Company; M-Bloc Type C.
d. CertainTeed Corporation; M2Tech 1/2" Moisture & Mold Resistant Drywall.
e. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall.
f. Georgia-Pacific Gypsum; ToughRock Mold-Guard.
g. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
h. National Gypsum Company; Gold Bond XP Gypsum Board.
i. USG Corporation; Sheetrock Brand Mold Tough (Firecode X).

2.04 GYPSUM BOARD ACCESSORIES

A. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
3. Products:
a. Phillips Manufacturing Co; Metal: www.phillipsmfg.com.
b. Stockton Products; Metal: www.stocktonproducts.com.
c. Trim-tex, Inc; Metal: www.trim-tex.com.

B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
2. Joint Compound: Drying type, vinyl-based, ready-mixed.

C. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

D. Nails for Attachment to Wood Members: ASTM C514.

E. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Studs: Space studs as indicated.
1. Extend partition framing to structure in all locations.

B. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated.

C. Blocking: Install wood blocking for support of:
1. Framed openings.
2. Wall-mounted cabinets.
3. Plumbing fixtures.
4. Toilet accessories.

3.03 BOARD INSTALLATION

A. Comply with ASTM C840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
1. Single-Layer Applications: Screw attachment.

2. Construct floating internal corners, except where special isolation or edge trim is indicated.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. At building expansion, seismic, or construction joints.
   2. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   3. At interior ceilings with perimeter relief; not more than 50 feet apart, and area contained within joints not to exceed 2,500 square feet.
      a. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.
   4. At interior ceilings without perimeter relief; not more than 30 feet apart, and area contained within joints not to exceed 900 square feet.
      a. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.
   5. At exterior ceilings; not more than 30 feet apart, and area contained within joints not to exceed 900 square feet.
      a. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.05 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.

3.06 TEXTURE FINISH

A. Apply finish texture coating by means of trowel in accordance with manufacturer's instructions.

B. Texture finish on walls and ceilings: 'Knock-down' texture

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Non-ceramic trim.

1.02 REFERENCE STANDARDS

A. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).

B. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2010 (Revised).

C. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.

D. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.

E. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles; 2014a.

F. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

G. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

H. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2016.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Tile: 1 percent of each size, color, and surface finish combination.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.05 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products of each type by the same manufacturer.
   1. American Olean Corporation: www.americanolean.com.
   2. Dal-Tile Corporation: www.daltile.com.
   3. Crossville Inc: www.crossvilleinc.com.

B. Glazed Wall Tile, Type T-1: ANSI A137.1, standard grade.
   1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
   2. Size: 4-1/4 by 4-1/4 inch, nominal.
   3. Edges: Cushioned.

4. Surface Finish: High gloss.
5. Color(s): To be selected by Owner from manufacturer's standard range.
6. Trim Units: Matching bullnose and cove base shapes in sizes coordinated with field tile.

C. Porcelain Tile: ANSI A137.1, standard grade.
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Size: 8 by 8 inch, nominal.
3. Thickness: 1/4 inch.
4. Edges: Square.
5. Surface Finish: Non-slip.
6. Color(s): To be selected by Owner from manufacturer's standard range.

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
a. Inside and outside wall corners.
b. Transition between floor finishes of different heights.
c. Thresholds at door openings.
2. Products:
a. Schluter-Systems: www.schluter.com.
b. Genesis APS International: www.genesis-aps.com.
c. Or approved equal.

2.03 SETTING MATERIALS

A. Manufacturers:
1. ARDEX Engineered Cements: www.ardexamericas.com.
2. Bostik Inc: www.bostik-us.com.
3. Custom Building Products: www.custombuildingproducts.com.
4. H.B. Fuller Construction Products, Inc; ____: www.tecspecialty.com/#sle.
5. LATICRETE International, Inc: www.laticrete.com.
6. Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
7. ProSpec, an Oldcastle brand: www.prospec.com.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
1. Applications: Use this type of bond coat where indicated, and where no other type of bond coat is indicated.
2. Products:
a. ARDEX Engineered Cements; ARDEX X 5: www.ardexamericas.com.
b. H.B. Fuller Construction Products, Inc; TEC TotalFlex 110 Universal Mortar: www.tecspecialty.com/#sle.
c. Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex: www.merkrete.com.
d. ProSpec, an Oldcastle brand; PermaFlex 500: www.prospec.com.
e. Or approved equal.

2.04 GROUTS

A. Manufacturers:
1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
2. Bostik Inc: www.bostik-us.com.
3. Custom Building Products: www.custombuildingproducts.com.
4. H.B. Fuller Construction Products, Inc; _____: www.tecspecialty.com/#sle.
5. LATICRETE International, Inc: www.laticrete.com.
6. Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
7. ProSpec, an Oldcastle brand: www.prospec.com.

B. Standard Grout: ANSI A118.6 standard cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.

3. Color(s): As selected by Architect from manufacturer's full line.

2.05 MAINTENANCE MATERIALS

A. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
   1. Composition: Water-based colorless silicone.

2.06 ACCESSORY MATERIALS

A. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Fluid or Trowel Applied Type:
      a. Thickness: 25 mils, minimum, dry film thickness.
      b. Products:
         1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
         2) AVM Industries, Inc; System 700 with continuous polyester fabric reinforcement: www.avmindustries.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Center floor tile in each room so as to maintain a border of not less than one-half tile.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

B. Over wood substrates, install in accordance with TCNA (HB) Method F150, with standard grout, unless otherwise indicated.

C. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.

3.05 CLEANING

A. Clean tile and grout surfaces.

3.06 PROTECTION

A. Do not permit traffic over finished floor surface for 2 days after installation.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

D. ASTM E1477 - Standard Test Method for Luminance Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers; 1998a (Reapproved 2013).

E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.

F. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

H. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.

I. ICC (IBC) - International Building Code; 2015.

J. UL (GGG) - GREENGUARD Gold Certified Products; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 8 inches long, of suspension system main runner.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Certification: Manufacturer's certification that products comply with specified requirements, including reports indicating compliance with specified tests and standards. For acoustical performance, each carton of acoustical units must carry an approved laboratory classification of NRC, CAC, and AC.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.05 QUALITY ASSURANCE

A. Seismic Design Category; ICC (IBC): Category C; Installation shall conform to ASTM E580/E580M Seismic Design Category C.

1.06 FIELD CONDITIONS

A. Standard Ceilings: Do not install interior ceilings until space is enclosed, weatherproof, and all wet work in place is completed and nominally dry.

B. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.07 WARRANTY

A. Provide manufacturer's standard written ten-year limited warranty to repair or replace components due to failure caused defects in material or factory workmanship.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION:

A. Continuous/Wall to Wall, seismically reinforced.

2.02 MANUFACTURERS

A. Acoustic Tiles/Panels Basis of Design:
   1. ACT-1: CIRRUS #578 manufactured by Armstrong World Industries, Inc.

B. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG Corporation: www.usg.com/ceilings.
   4. Or approved equal.

C. Suspension Systems:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Chicago Metallic/Rockfon, LLC: www.rockfon.com.
   4. USG Corporation: www.usg.com/ceilings.

2.03 PERFORMANCE REQUIREMENTS

2.04 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. VOC Content: Certified as Low Emission by one of the following:
      a. Product listing in UL (GGG).
      b. Product listing in CHPS (HPPD).
   2. Fire Classification: Class A in accordance with ASTM E84:
      a. Flame spread: 25 maximum.
      b. Smoke generated: 50 maximum.
   3. Dimensional Stability: Panels shall remain unaffected by temperatures to 120 degrees F and relative humidity levels of 100 percent.

B. Acoustical Panels, Type ACT-1: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
      a. Form: 2, water felted.
      b. Pattern: "D" - fissured.
   2. Size: 24 by 24 inches.
   3. Thickness: 3/4 inch.
   4. Light Reflectance: 86 percent, determined in accordance with ASTM E1264.
   5. NRC Range: 0.30 to 0.35, determined in accordance with ASTM E1264.
   6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   7. Panel Edge: Square.
   8. Tile Edge: Beveled.
      a. Joint: Tegular.
   9. Color: White.
   10. Suspension System: Exposed grid.

C. Gypsum Ceiling Panels Type ACT-2: Lightweight glass-enhanced gypsum panels with fiberglass fabric face, with 70 percent post-consumer recycled glass.

1. Size: 24 by 24 inches.
2. Light Reflectance: 83 percent, determined in accordance with ASTM E1477.
3. Panel Edge: Reveal for 15/16 inch grid.
4. Surface Pattern: Coffered.
5. Surface Color: White.
6. Suspension System: Exposed grid.

2.05 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

B. Exposed Suspension System: Hot-dipped galvanized steel grid and cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 15/16 inch face width.
   3. Finish: Baked enamel.
   4. Color: White.

2.06 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: Same material and finish as grid; size and type to suit application, and seismic requirements.
   1. Size: As required for installation conditions.
   2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify all work above ceilings is complete.

C. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

F. Where round obstructions occur, provide preformed closures to match perimeter molding.

G. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient stair accessories.

C. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

C. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2013a.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

E. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015.

F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

G. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

H. RFCI (FloorScore) - Resilient Floor Covering Institute Indoor Air Quality certification program.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Flooring Material:
      a. Community Building: Amount equal to 5 percent of each type and color.
      b. Dwelling Unit Buildings: Amount equal to10 percent of each type and color for each multi-unit building.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 65 degrees F and 90 degrees F.

D. Do not double stack pallets.

1.05 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature between 65 degrees F and 85 degrees F to achieve temperature stability. Thereafter, maintain conditions above 65 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Plank: Printed film type, with transparent or translucent wear layer, floating or adhered.
   1. Manufacturers:
      a. Mannington Commercial; ADURA Flex: www.manningtoncommercial.com.
      b. Metroflor Corporation; Konecto - 'Project Plank': www.aspectaflooring.com.
      c. Shannon Specialty Floors, Inc; Tuf Stuf Woodland Path: www.shannonspecialtyfloors.com.
      d. Or approved equal.
   2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   4. VOC Content Limits: As specified in Section 01 61 16.
   5. Plank Tile Size: 6 by 36 inch.
   6. Wear Layer Thickness: 0.012 inch.
   7. Total Thickness: 0.177 inch.
   8. Color: To be selected by Owner from manufacturer's full range.

2.02 STAIR COVERING

A. Stair Treads: Rubber; full width and depth of stair tread in one piece; tapered thickness.
   1. Manufacturers:
      a. Johnsonite, a Tarkett Company; Angle Fit: www.johnsonite.com.
      b. Mannington Commercial; Linear Series: www.manningtoncommercial.com.
      c. Or approved equal.
   2. Minimum Requirements: Comply with ASTM F2169, Type TP, rubber, thermoset.
   3. Nominal Thickness: 0.1875 inch.
   4. Nosing: Square.
   5. Texture: Smooth.
   6. Color: As selected by Owner.

B. Stair Risers: Full height and width of tread in one piece, matching treads in material and color.
   1. Thickness: 0.080 inch.

2.03 ACCESSORIES

A. Subfloor Filler: Fast-setting, portland-cement based; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
   1. VOC Content Limits: As specified in Section 01 61 16.

C. Moldings, Transition and Edge Strips: Same material as flooring.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

D. Prohibit traffic until filler is fully cured.

E. Clean substrate.

F. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Loose-Laid Installation: Set flooring in place in accordance with manufacturer's instructions.
   1. Fit interlocking edges tightly.

E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
   2. Resilient Strips: Attach to substrate using adhesive.

G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

H. Install flooring in recessed floor access covers, maintaining floor pattern.

3.04 INSTALLATION - PLANK FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

C. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.05 INSTALLATION - STAIR COVERINGS

A. Adhere over entire surface. Fit accurately and securely.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

B. If construction activities are on-going, provide heavy, undyed, kraft paper protective coverings to prevent damage. Replace as required.

END OF SECTION

SECTION 09 68 16
SHEET CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet, stretched-in with cushion underlay.

B. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

E. CRI (GL) - Green Label Testing Program - Certified Products; Current Edition.

F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two samples 12 by 12 inch in size illustrating color and pattern for each carpet and cushion material specified.

D. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 72 hours prior to installation.

B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carpet:
   1. J & J Industries, Inc: www.jjindustries.com.
   2. Milliken & Company: www.milliken.com.
   3. Mohawk Group: www.mohawkgroup.com.
   4. Shaw Industries Group: www.shawfloors.com.

B. Cushion:
   1. Healthier Choice Flooring, LLC: www.healthierchoice.com.
   2. Leggett & Platt, Inc: www.lpurethane.com.
   3. Proflex Products, Inc: www.proflex.us.

2.02 CARPET

A. Carpet; Dwelling Units:
   1. Product: Medium Pile; as selected by Owner.
   2. Roll Width: 12 ft.

3. Face Weight: 18 oz/sq yd.
4. Dye Method: Solution Dyed.
5. Fiber Treatment: Soil/Stain Protection and Antimicrobial.
6. Secondary Backing:
   a. Material: Classicbac.
7. Maximum Electrostatic Charge: 3 Kv. at 20 percent relative humidity (RH).
8. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
9. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
10. VOC Content: Comply with Section 01 61 16.

B. Owner/Architect shall determine if alternate manufacturer style/colors submitted are equal to basis of specification.

C. All carpeting shall be back-stamped in accordance with HUD UM Bulletin No. 44d. Certificate of compliance to be given to Owner at project completion.

D. For each type of carpeting specified; all carpeting shall be from the manufacturer's same dye lot.

2.03 CUSHION

A. Cushion: Synthetic Fiber; Typical Dwelling Units (omit at Accessible Units).
1. Product: Syntex manufactured by Leggett & Platt.
2. Nominal Thickness: 0.275 inch.
3. Weight: 24 oz/sq yd.
4. Density: 7 lb/cu ft.

B. HUD UM Bulletin No.72 compliant. Certificate of compliance to be given to Owner at project completion.

2.04 ACCESSORIES

A. Subfloor Filler: Type recommended by carpet manufacturer.

B. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.

C. Moldings and Edge Strips: Vinyl, color as selected.
1. All transitional strips shall comply with the applicable accessibility codes requirements.

D. Adhesives:
1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GL) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

E. Seam Adhesive: Recommended by carpet manufacturer.

F. Carpet Adhesive: Recommended by carpet manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesives to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
1. Test as Follows:
   a. Alkalinity (pH): ASTM F710.
   b. Moisture Vapor Emission: ASTM F1869.
2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet and cushion in accordance with manufacturer's instructions.

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 STRETCHED-IN CARPET - TYPICAL DWELLING UNITS

A. Install tackless strips with pins facing the wall around entire perimeter, except across door openings. Use edge strip where carpet terminates at other floor coverings.

B. Space tackless strips slightly less than carpet thickness away from vertical surfaces, but not more than 3/8 inch.

C. Install cushion in maximum size pieces using spot adhesive to adhere to subfloor.

D. Lay out cushion so that seams will be perpendicular to, or offset from, minimum 6 inches from carpet seams.

E. Butt cushion edges together and tape seams.

F. Trim cushion tight to edge of tackless strip and around projections and contours.

G. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to all cut edges immediately.

H. Join seams using hot adhesive tape. Form seams straight, not overlapped or peaked, and free of gaps.

I. Following seaming, hook carpet onto tackless strip at one edge, power stretch, and hook firmly at other edges. Follow manufacturer's recommendations for method and amount of stretch.

J. Trim carpet neatly at walls and around interruptions. Tuck edges into space between tackless strip and wall.

K. Complete installation of edge strips, concealing exposed edges.
   1. Installation of transitional strips shall not begin until the work of all other trades has been completed, especially overhead trades.

3.05 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Install temporary surface protection over carpet material in areas where other construction activities or construction foot traffic are still present and/or where snow, rain, mud, dirt, etc. may be tracked into area from the outside.

C. After all construction activities are complete, clean and vacuum carpet surfaces of all dirt, debris, stains, and residues per manufacturer's written instructions.

END OF SECTION

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Materials for backpriming woodwork.

D. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Factory-primed Entry doors.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. All surfaces of shop primed steel stairs except concrete treads.
   4. Steel Bollards.
   5. Mechanical and Electrical:
      a. Exposed pipe and conduit.

E. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   4. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
   5. Floors, unless specifically indicated.
   6. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
   7. Glass.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2015.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

D. SSPC-SP 1 - Solvent Cleaning; 2015.

E. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

F. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   3. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.
   1. All materials used on the work shall be stored in a single place designated by the Owner/Architect and shall be kept clean and orderly at all times.
   2. Care shall be taken to prevent damage to the storage area, and any damage incurred shall be repaired.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

B. Paints:
   1. Behr Paint Company; _____: www.behr.com/#sle.
   2. Benjamin Moore Paints: www.benjaminmoore.com.
   3. PPG Paints: www.ppgpaints.com.
   4. Sherwin-Williams Company: www.sherwin-williams.com.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   4. Supply each paint material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 61 16.

C. Colors: To be selected from manufacturer's full range of available colors.
   1. Selections to be made by Owner.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete masonry units, fiber cement siding, engineered wood siding, primed wood, and primed urethane decorative elements.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Exterior Latex.
   3. Top Coat Sheen:
      a. Flat: MPI gloss level 1; use this sheen for overhead surfaces.
      b. Satin: MPI gloss level 4; use this sheen at all locations.

B. Paint ME-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
   1. One coat of alkyd, water based primer.
   2. Semi-gloss: Two coats of alkyd, water based, enamel.

C. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, Water Based, 3 Coat:
   1. Applications include factory-primed entry doors, steel stairs, handrails, guardrails, and bollards.
   2. One coat of alkyd, water based primer.
      a. Entry doors: Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
   3. Semi-gloss: Two coats of water based alkyd enamel.

D. Paint MgE-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
   1. Applications include galvanized metal fabrications, flashing, and trim.
   2. One coat galvanize primer.
   3. Semi-gloss: Two coats of alkyd, water based, enamel.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
   1. Interior/Exterior Latex Block Filler.
   2. Rust-Inhibitive Water Based Primer; MPI #107.
   3. Latex Primer for Exterior Wood; MPI #6.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Fiber Cement Siding: 12 percent.
   2. Engineered Wood Siding: 12 percent.
   3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Masonry:
   1. Prepare surface as recommended by top coat manufacturer.
   2. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.

G. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

H. Engineered Wood Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

I. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

J. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

K. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

L. Metal Entry Doors to be Painted: Shop-Primed Surfaces; Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Exterior steel stairs: Paint sides of stringers, landings, and other components adjacent to building construction, or that otherwise would be inaccessible after installation, prior to erection.

D. Apply products in accordance with manufacturer's written instructions.

E. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

F. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

G. Apply each coat to uniform appearance.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Upon completion of the work, the Contractor shall remove all paint spots from all decks, patios, glass, and adjacent surfaces.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Materials for backpriming woodwork.

D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Both sides and all edges of interior wood doors.
   3. Mechanical and Electrical:
      a. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

E. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   4. Floors, unless specifically indicated.
   5. Ceramic and other tiles.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2015.

C. SSPC-SP 1 - Solvent Cleaning; 2015.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. Cross-reference to specified paint system products to be used in project; include description of each system.
   3. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.
   1. All materials used on the work shall be stored in a single place designated by the Owner/Architect and shall be kept clean and orderly at all times.
   2. Care shall be taken to prevent damage to the storage area, and any damage incurred shall be repaired.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for submittals.

B. Paints:
   1. Behr Paint Company: www.behr.com.
   2. Benjamin Moore Paints: www.benjaminmoore.com.
   3. Diamond Vogel Paints: www.diamondvogel.com.
   4. PPG Paints: www.ppgpaints.com.
   5. Sherwin-Williams Company: www.sherwin-williams.com.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   4. Supply each paint material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: See Section 01 61 16.

C. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Owner.
   2. Extend colors to surface edges; colors may change at any edge as directed by Architect or Owner.
   3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, uncoated steel, and shop primed steel.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Interior Latex.
   3. Top Coat Sheen:
      a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
      b. Eggshell: MPI gloss level 3; use this sheen at all locations.
   4. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
   1. Medium duty applications include doors, door frames, window sills and casing, and wood baseboards.
   2. Two top coats and one coat primer.
   3. Top Coat(s): Interior Alkyd, Water Based.
   4. Top Coat Sheen:
      a. Eggshell: MPI gloss level 3; use this sheen at at all locations except doors.
      b. Semi-Gloss: MPI gloss level 5; use this sheen at door edges and faces.
   5. Primer: As recommended by top coat manufacturer for specific substrate.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
   1. Interior Latex Primer Sealer.
   2. Latex Primer for Interior Wood.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.
   1. Clean floors and all adjacent surfaces prior to application.

B. Mask or otherwise protect floors, adjacent walls, fixtures, and other construction throughout application.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.

H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

I. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

J. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

K. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

L. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with tinted primer.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Upon completion of the work, the Contractor shall remove all paint spots from the floors, glass and adjacent surfaces.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Interior directional and informational signs.

C. Building Identification signs.

D. Dwelling Unit identification signs.

E. Monument Sign.

1.02 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. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

D. UFAS - Uniform Federal Accessibility Standards - HUD 24 CFR part 40; 1984.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. Submit for approval by Owner through Architect prior to fabrication.

D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.05 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
   1. Best Sign Systems, Inc; HC300: www.bestsigns.com.
   2. Cosco Industries (ADA signs); ADA Series 2: www.coscoarchitecturalsigns.com.
   3. Inpro; Aspen Series: www.inprocorp.com.
   4. Mohawk Sign Systems, Inc; Mohawk 1000 Sand Carved: www.mohawksign.com.
   5. National Signage Affiliates; PoliTouch Series: www.nationalsignageaffiliates.com
   6. Stamprite Supersine, Inc.; Supersine TFA: www.supersine.com

B. Dimensional Letter & Numbers:
   1. Cosco Industries; Injection Molded Acrylic: www.coscoarchitecturalsigns.com.
   2. Or approved Equal.

C. Dwelling Unit Identification Signs:
   1. Best Sign Systems, Inc; Graphic Blast FG: www.bestsigns.com.
   2. Inpro; Photopolymer: www.inprocorp.com.
   3. Mohawk Sign Systems, Inc; Series 200A : www.mohawksign.com.
   4. Stamprite Supersine, Inc.; Supersine PPA: www.supersine.com

D. Egress Door Signs:
   1. Lynch Signs, Inc.: www.lynchsign.com.
   2. Seton Identification Products: www.seton.com.
   3. Compliance Signs, Inc.: www.compliancesigns.com.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with, UFAS, ADA Standards, and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide signs as indicated in Signage Schedule.
   1. Sign Type: Flat signs with raised panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Character Height: Refer to drawings..
   4. Sign Size: As required to accommodate required graphics and text.
      a. Maintain consistent size throughout building.
   5. Room Doors: Identify with room names as scheduled.
   6. Public Toilet Room(s): Identify with pictograms, "MEN" and "WOMEN", International accessibility symbol, and braille.

C. Interior Directional and Informational Signs:
   1. Sign Type: Same as room and door signs.

D. Building Identification Signs:
   1. Sign Type: Dimensional Letter/Numbers.
   2. Material: injection molded plastic.
   3. Height: 12 inches
   4. Install at building exteriors as directed by Owner

E. Dwelling Unit Identification Signs:
   1. Sign Type: Flat signs with raised panel media as specified.
   2. Material: Fiberglass or Photopolymer signs.
   3. Mounting: Countersunk Screws.
   4. Install on outside wall at apartment entries as directed or indicated on drawings.

F. Apartment Directional Signs:
   1. Sign Type: Flat signs with raised panel media as specified.
   2. Material: Photopolymer signs.
   3. Mounting: Countersunk Screws.

G. Monument Sign: Provide sign as indicated on Drawings.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
   3. Wall Mounting of Interior One-Sided Signs: Tape adhesive or silicone adhesive.
   4. Wall Mounting of Exterior One-Sided Signs: Countersunk screws.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: Selected by Owner/Architect.
   4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/8 inch.

B. Injection Molded Panels: One-piece acrylic plastic, with raised letters and braille.
   1. Total Thickness: 1/8 inch.

C. Applied Character Panels: Acrylic plastic base, with applied acrylic plastic letters and braille.
   1. Total Thickness: 1/8 inch.
   2. Letter Thickness: 3/32 inch.
   3. Letter Edges: Square.

2.05 DIMENSIONAL LETTERS

A. Plastic Letters:
   1. Material: Injection molded plastic.
   2. Color: As selected.
   3. Mounting: Concealed or exposed screws.

2.06 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Exposed Screws: Chrome plated.

C. Tape Adhesive: Double sided tape, permanent adhesive.

D. Silicone Adhesive: Type as recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

PART 4 SCHEDULES

4.01 FLAT AND TACTILE SIGNAGE SCHEDULE1`

DESCRIPTION/TEXT	LOCATION	QUANTITY
DIMENSIONAL NUMBERS		
Building Number/Address	Exterior	1
FLAT SIGNS		
Apartment Wayfinding Signs	Interior	1 per elevator lobby
TACTILE SIGNS		
Dwelling Unit Numbers	Interior	1 per Unit
Leasing Office	Interior	1
Learning Center	Interior	1
Laundry	Interior	1
Women (with international accessiblity symbol)	Interior	3
Men (with international accessiblity symbol)	Interior	3
Elevator Equipment	Interior	1
Community Room	Interior	1

Fitness Center	Interior	1
Stairs (outside stairway)	Interior	2 per Floor
Ground Floor (inside stairway)	Interior	2
2nd Floor (inside stairway at level, 2)	Interior	2
3rd Floor (inside stairway at level, 3)	Interior	2
4th Floor3rd Floor (inside stairway at level, 4)	Interior	2
Mechanical	Interior	3
Stairs (Building Exterior)	Exterior	2
Sprinkler Room	Exterior	1
Maintenance	Interior	2

END OF SECTION

SECTION 10 28 00
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories for Dwelling Unit Bathrooms and Public Toilet Rooms.

B. Grab bars.

1.02 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.

E. ASTM C1036 - Standard Specification for Flat Glass; 2011.

F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fixture and Accessory Manufacturers::
   1. Better Homes Products, Inc.: www.betterhomesproducts.com.
   2. Pfister, a Spectrum Brands company: www.pfisterfaucets.com.
   3. Delta Faucet Company, Inc.: www.deltafaucet.com.

B. Commercial Toilet and Shower Accessories:
   1. ASI - American Specialties, Inc: www.americanspecialties.com.
   2. Bradley Corporation: www.bradleycorp.com.
   3. Bobrick Washroom Equipment Inc.: www.bobrick.com.

C. Provide products of each category type by single manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Keys: Provide 2 keys for each accessory to Owner.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Type 304.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

G. Adhesive: silicone, waterproof.

H. Fasteners, screws, and bolts: Corrosion resistant or stainless steel.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

2.04 TOILET AND BATHROOM ACCESSORIES

A. Toilet Paper Dispenser: Single roll, surface mounted bracket type, nickel-plated solid brass.
   1. Product: Candlestick Park #2209 manufactured by Better Homes Products, or equal.

B. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
   1. Capacity: 400 multifold minimum.
   2. Product: Model # B262 manufactured by Bobrick, or equal.

C. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.
   1. Minimum Capacity: 40 ounces.
   2. Products:
      a. Model # B4112 manufactured by Bobrick, or equal.

D. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Size: As indicated on drawings.
   3. Frame: 0.04 inchchannel shapes, with mitered and welded and ground corners; satin finish.
   4. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.

E. Grab Bars: Stainless steel, textured surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Finish: Safety-grip.
      d. Length and Configuration: As indicated on the Drawings.
      e. Product: Series 832 manufactured by Bradley, or equal.

F. Shower Curtain Rod: Stainless steel tube, 1 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for concealed mounting.
   1. Product: Model B-207 manufactured by Bobrick, or equal.

G. Shower Seat: Frameless removable polymeric seat composed of multiple slats capable of supporting 250 pounds, surface-mounted wall bracket of Type 304 stainless steel; 18 guage (0.48 inches).
   1. Seat: Polymeric plastic (HDPE), molded multi-slat seat. Foldable for storage
   2. Size: 15 by 29 inches.
   3. Color: White.
   4. Products:
      a. Seachrome Products; TFRS-290150MW: www.seachrome.com.
      b. Or approved equal.

H. Towel Bar: Solid brass, nickel-plated.
   1. Finish: Satin.
   2. Length: 24 inches.
   3. Product: Candlestick Park #2224 manufactured by Better Homes Products, or equal.

I. Towel Ring: Solid brass, nickel-plated, 2-1/2 inch extension from wall, with round ring, for concealed attachment.
   1. Finish: Satin.
   2. Product: Candlestick Park #2204 manufactured by Better Homes Products, or equal.

J. Robe Hook: Solid brass, nickel-plated, double-prong for concealed attachment.
   1. Finish: Satin.
   2. Product: Candlestick Park #2202 manufactured by Better Homes Products, or equal.

K. Under-Counter Pipe and Drain Covers
   1. Specified in 22 00 00 - Plumbing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 06 10 00 - Rough Carpentry for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

A. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.
   1. Towel bars and shower curtain rods shall be secured to solid blocking or studs.
   2. Grab bars shall be secured to solid blocking capable of withstanding a 250 pound-force of 5 minute duration.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on drawings.
   2. Mirrors: 40 inch, measured from floor to bottom of mirrored surface.
   3. Robe Hooks:
      a. Typical locations: 60 inches measured to top of hook.
      b. Accessible locations: 48 inches measured to top of hook.
   4. Other Accessories: As indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

PART 4 ACCESSORY SCHEDULES

4.01 PUBLIC TOILET ROOMS

Qty	Description	Model #	Mfr
1	Toilet Paper Holder; surface-mounted	#2209	BHP
1	Paper Towel Dispenser; surface-mounted	#B262	Bobrick
1	Mirror; size as indicated	---	---
1	Grab Bar; 42 inch	BR832-00142	Bradley
1	Grab Bar; 36 inch	BR832-00136	Bradley
1	Grab Bar; 18 inch	BR832-00118	Bradley

4.02 FHA DWELLING UNIT BATHROOMS AND ADA BATHROOM #2

Qty	Description	Model #	Mfr
1	Toilet Paper Holder; surface-mounted	#2209	BHP
1	Mirror; size as indicated	---	---
1	Shower Curtain Rod	B-207	Bobrick
1	Towel Bar; 24 inch	#2224	BHP
1	Towel Ring	#2204	BHP
1	Robe Hook, typical height	#2202	BHP

4.03 ADA DWELLING UNIT BATHROOMS

Qty	Description	Model #	Mfr
1	Toilet Paper Holder; surface-mounted	#2209	BHP
1	Mirror; size as indicated	---	---
1	Grab Bar; 42 inch (toilet)	BR832-00142	Bradley
1	Grab Bar; 36 inch (toilet)	BR832-00136	Bradley
1	Shower Curtain Rod	B-207	
1	Grab Bar; 18 inch (tub/shower)	BR832-00118	Bradley
3	Grab Bar; 24 inch (tub/shower)	BR832-00124	Bradley
1	Grab Bar; 12 inch (tub/shower)	BR832-00112	Bradley
1	Shower Seat (Tub-mount)	TFRS-290150MW	Seachrome
1	Towel Bar; 24 inch	#2224	BHP
1	Towel Ring	#2204	BHP
1	Robe Hook; accessible height	#2202	BHP

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, and anchorage details.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Kidde, a unit of United Technologies Corp: www.kidde.com.
   2. Nystrom, Inc: www.nystrom.com.
   3. Pyro-Chem, a Tyco Business: www.pyrochem.com.
   4. Strike First Corporation of America: www.strikefirstusa.com.

B. Fire Extinguisher Cabinets and Accessories:
   1. JL Industries, Inc; Ambassador 1016F10-FX2: www.jlindustries.com.
   2. Larsen's Manufacturing Co; Model FS 2409-5R: www.larsensmfg.com.
   3. Potter-Roemer; Model FRC7020: www.potterroemer.com.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Stored Pressure Operated: Deep Drawn.
   2. Class: A:B:C type.
   3. Size: 5 pound; For installation in Common areas.
   4. Size: 2.5 pound; For installation in individual Dwelling Units.
   5. Finish: Baked polyester powder coat, Red color.
   6. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Fire Rated Cabinet Construction: One-hour fire rated.
   1. Steel; double wall or outer and inner boxes with 5/8 inch thick fire barrier material.

B. Cabinet Configuration: Semi-recessed type.
   1. Exterior nominal dimensions of 14 inch wide by 27 inch high by 4 inch deep.
   2. Trim: Flat, with 3/8 inch wide face.

C. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, full view bubble shape and set in resilient channel glazing gasket.

D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

E. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

F. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated, by extinguisher manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install brackets plumb and level.

C. Secure rigidly in place.

D. Install Common Area extinguishers in fire extinguisher cabinets.

1. Provide Multi-Purpose Dry Chemical extinguishers in Common Room, Learning Center, and Maintenance Rooms.
2. Install cabinets where indicated or otherwise directed with handle of extinguisher 48 inches above finished floor, maximum.

E. Install Dwelling Unit fire extinguishers in brackets, where indicated or otherwise directed.

1. Extinguisher brackets in Accessible Dwelling Units shall be mounted in conspicuous, accessible locations and with bottom of extinguisher 27 inches above finished floor, maximum.

END OF SECTION

SECTION 10 55 00

POSTAL SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Central mail delivery boxes.

1.02 REFERENCE STANDARDS

A. 39 CFR 111 - U.S. Postal Service Standard 4C; effective date September 3, 2006.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, maintenance information, and current USPS approval documentation.

C. Shop Drawings: Indicate plans for each unit or groups of units, front elevations with compartment layout and model number, overall dimensions, rough-in opening sizes, construction and anchorage details.

1.04 WARRANTY

A. Provide manufacturer's warranty against defects in materials or workmanship for a period of 5 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CENTRAL MAIL DELIVERY BOXES

A. Manufacturers:
   1. Florence Manufacturing Company: www.florencemailboxes.com.
   2. Salsbury Industries: www.mailboxes.com.

B. Central Mail Delivery Boxes: Provide products approved for United States Postal Service (USPS) delivery.
   1. Materials: Aluminum with stainless steel hardware.
   2. Finish: Powder coat in color selected by Owner from manufacturer's standard colors.
   3. Unit Types and Sizes: As specified.
   4. Configurations: Refer to Drawings for quantity of units and locations.
      a. Provide a minimum of one (1) customer compartment for each Dwelling Unit and the Manager's office.

C. Wall-Mounted Mailboxes:, Complying with 39 CFR 111 (USPS-STD-4C).
   1. Unit A: Front-loading with pair of master doors, double-column design, 9 customer compartments, 1 outgoing mail compartment, and 2 parcel compartments.
      a. Florence Manufacturing Company; Model 4CADD-09.
      b. Quantity: 11 Units.

2.02 COMPONENTS

A. Locking - Front Loading Master Door: Three-point latching mechanism with USPS master lock furnished and installed by postmaster.

B. Locking - Customer Compartment Doors: USPS approved cam lock, 3 keys each lock.

C. Locking - Parcel Compartment Doors: Double-lock arrangement with USPS approved cam lock for customer access, and USPS master lock furnished and installed by postmaster.

D. Identification - Customer and Parcel Compartments: Sequential numerical or alphabetic characters, top to bottom, left to right; factory-installed.
   1. Silver adhesive decals, 3/4 inch high black characters centered on 1-1/2 inch high by 1-3/4 inch long decal.
   2. Customer Name Marking: Self-adhesive labels; attach below front of each compartment shelf.

PART 3 EXECUTION

3.01 EXAMINATION

A. Coordinate location of postal specialties with local USPS District authority.

B. Verify that concrete base and anchor bolts are ready to receive pedestal-mounted units.

C. Verify that rough-openings are ready to receive wall-mounted units.

D. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

A. Install postal specialties in accordance with approved shop drawings, manufacturer's instructions, and USPS requirements.

B. Adjust and lubricate door hardware to operate properly.

END OF SECTION

SECTION 10 57 23

CLOSET AND UTILITY SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted wire closet shelving.

B. Accessories.

1.02 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, with installation instructions.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

C. Store flat to prevent warpage and bending.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wire Storage Shelving:
   1. ClosetMaid Corporation: www.closetmaidpro.com.
   2. Rubbermaid, Inc: www.rubbermaidpro.com.

2.02 WIRE STORAGE SHELVING SYSTEMS

A. Applications:
   1. Shelf Depth: 12 inches, unless otherwise indicated.
   2. Bedroom Closets:
      a. Wall-to-wall shelf with free sliding hanger rod.
      b. Provide intermediate bracing for shelves longer than 36 inches.
   3. Coat Closets:
      a. Wall-to-wall shelf with integral hanger rod.
      b. Provide intermediate bracing for shelves longer than 36 inches.
   4. Linen and Pantry Shelving:
      a. Wall-to-wall shelves spaced as shown on the drawings, not less than 16 inch deep.

B. Wire Shelving: Factory-assembled coated wire mesh shelf assemblies for wall-mounting, with components and connections required to produce a rigid structure that is free of buckling and warping.
   1. Construction: Cold-drawn steel wire with average tensile strength of 100,000 psi resistance welded into uniform mesh units, square, rigid, flat, and free of dents or other distortions, with wires trimmed smooth.
   2. Coating: PVC or epoxy, applied after fabrication, covering surfaces.
   3. PVC Coating: 9 to 11 mils thick.
   4. Epoxy Coating: Nontoxic epoxy-polyester powder coating baked-on finish, 3 to 5 mils thick.
   5. Standard Mesh Shelves: Cross deck wires spaced at 1 inch.
   6. Close-Mesh Shelves: Cross deck wires spaced at 1/2 inch.
   7. Shelf and Rod Units: Integral hanging rod at front edge of shelf.
   8. Free-Sliding Hanging Rod: Integral hanging rod that permits uninterrupted sliding of hangers the full width of the shelf.

C. Hanging Rod: Tubular steel, 1 inch diameter, with end caps on open ends.
   1. Finish: Epoxy powder coat.
   2. Wall Thickness: 20 gauge, 0.035 inch.

D. Wall-Mounted Standards for Wire Shelving: Vertically slotted channel standards with double-tab cantilever brackets to suit shelving; factory finished to match shelving.

E. Mounting Hardware for Wire Shelving: Provide manufacturer's standard mounting hardware; include support braces, wall brackets, back clips, end clips, poles, and other accessories as required for complete and secure installation; factory finished to match shelving.

F. Fasteners: As recommended by manufacturer for mounting substrates.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect areas to receive shelving or storage system, to verify that spaces are properly prepared to receive shelf units, and are of dimensions indicated on shop drawings.

B. Verify appropriate fastening hardware.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install wire shelving in accordance with manufacturer's instructions, with shelf surfaces level.

B. Cap exposed ends of cut wires and hanging rods.

C. Install back clips, end clips at side walls, and support braces at open ends. Install intermediate support braces at 32 inches on center, maximum, or as recommended by manufacturer.

D. Mounting Heights:
   1. Single Hanging Rod Units:
      a. Typical Dwelling Units Install shelf at 68 inches above floor.
      b. Accessible Dwelling Unit(s) install shelf at 48 inches maximum above floor.

3.04 CLEANING

A. Clean soiled surfaces after installation.

3.05 PROTECTION

A. Protect installed work from damage.

B. Touch-up, repair, or replace damaged products before Substantial Completion in a manner that eliminates evidence of replacement.

END OF SECTION

SECTION 11 30 13
RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Kitchen appliances.

B. Commercial Laundry appliances.

1.02 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

1.05 SERVICE AGREEMENT

A. Provide one (1) year service contract on all appliances with qualified local area dealer or bona fide repair service, regardless of where purchased.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

A. Energy Star Rating: Provide Equipment Eligible for Energy Star Rating where available and applicable.

B. Refrigerator; ADA Dwelling Units, and Community Room Kitchenette: Free-standing, top-mounted freezer, and frost-free.
   1. Capacity: Total minimum storage of 17.0 cubic ft; minimum 25 percent freezer capacity.
   2. Energy Usage: Energy Star Rated.
   3. Features: Include glass shelves, automatic icemaker, light in freezer compartment, and ADA compliant front-mounted controls.
   4. Exterior Finish: Porcelain enameled steel, color as selected by Owner.
   5. Manufacturers:
      a. To be selected by Owner.

C. Refrigerator; FHA Dwelling Units: Free-standing, top-mounted freezer, and frost-free.
   1. Capacity: Total minimum storage of 17.0 cubic ft; minimum 29 percent freezer capacity.
   2. Energy Usage: Energy Star Rated.
   3. Features: Include glass shelves, automatic icemaker, and light in freezer compartment.
   4. Exterior Finish: Porcelain enameled steel, color as selected by Owner.
   5. Manufacturers:
      a. To be selected by Owner.

D. Range; ADA Dwelling Units: Electric, free-standing, with plug-in heating elements and removable drip pans.
   1. Size: 30 inches wide.
   2. Oven: Self-cleaning.
   3. Elements: Four (4).
   4. Controls: Solid state electronic.
   5. Features: Include oven door window, broiler pan and grid, oven light, anti-tip restraint, and front mounted controls.
   6. Exterior Finish: Porcelain enameled steel, color as selected by Owner.
   7. Manufacturers:
      a. To be selected by Owner.

E. Range; FHA Dwelling Units: Electric, free-standing, with plug-in heating elements and removable drip pans.
   1. Size: 30 inches wide.
   2. Oven: Self-cleaning.
   3. Elements: Four (4).
   4. Controls: Push-to-turn knobs with electronic clock and timer.
   5. Features: Include oven door window, broiler pan and grid, oven light, and anti-tip restraint.
   6. Exterior Finish: Porcelain enameled steel, color as selected by Owner.
   7. Manufacturers:
      a. To be selected by Owner.

F. Cooking Exhaust; ADA Dwelling Units: Range hood; fan and light wired to wall switches. Refer to drawings for switch heights.
   1. Size: 30 inches wide.
   2. Fan: Two-speed, 220 cfm
   3. Exhaust: Recirculating.
   4. Features: Include cooktop light and removable grease filter.
   5. Exterior Finish: Painted steel, color as selected by Owner.
   6. Manufacturers:
      a. To be selected by Owner.

G. Microwave/Hood; FHA Dwelling Units: Over-the-range, microwave/hood combination.
   1. Capacity: 1.7 cubic ft.
   2. Power: 1000 watts.
   3. Fan: Two-speed, 220 cfm
   4. Exhaust: Recirculating.
   5. Features: Include turntable, cooktop light, night light, 2-speed exhaust fan, built-in trim kit, and undercabinet mounting kit.
   6. Exterior Finish: Painted steel, color as selected by Owner.
   7. Manufacturers:
      a. To be selected by Owner.

H. Microwave; ADA Dwelling Units, and Community Room Kitchenette: Countertop.
   1. Capacity: 1.3 cubic ft.
   2. Power: 1000 watts.
   3. Height: 12 inches maximum.
   4. Features: Include turntable.
   5. Exterior Finish: Painted steel, color as selected by Owner.
   6. Manufacturers:
      a. To be selected by Owner.

I. Convection Oven, Community Room Kitchenette: Countertop.
   1. Size: 12 inch.
   2. Features: pre-programmed cooking fuctions, broil, interior light, non-stick coated racks, and timer.
   3. Exterior Finish: Painted steel, color as selected by Owner.
   4. Manufacturers:

J. Dishwasher; ADA Dwelling Units: Undercounter, for installation at 34 inch counters.
   1. Controls: Solid state electronic.
   2. Energy Usage: Energy Star Rated.
   3. Wash Options: Two (2).
   4. Cycles: Six (6), including heavy, sanitize, normal, eco, quick, and rinse and hold.
   5. Features: Include rinse aid dispenser, optional no-heat dry, optional water temperature boost, adjustable upper rack, and adjustable lower rack.
   6. Finish: Porcelain enameled steel, color as selected by Owner.
   7. Manufacturers:
      a. To be selected by Owner.

K. Dishwasher; FHA Dwelling Units: Undercounter.
   1. Controls: Solid state electronic.
   2. Energy Usage: Energy Star Rated.

3. Wash Options: Three (3).
4. Cycles: Four (4), including heavy, normal, light, and auto-sense.
5. Features: Include rinse aid dispenser, optional no-heat dry, optional water temperature boost, adjustable upper rack, and customizable bottom rack .
6. Finish: Porcelain enameled steel, color as selected by Owner.
7. Manufacturers:
   a. To be selected by Owner.

2.02 COMMERCIAL LAUNDRY APPLIANCES

A. Provide Equipment Eligible for Energy Star Rating.

B. Clothes Washer, Top-Loading: Commercial Grade; Coin-operated.
1. Size: Large capacity.
2. Controls: Solid state electronic.
3. Cycles: Include normal, permanent press, delicate, and soak.
4. Motor Speed: Two-speed, three combinations.
5. Features: Include bleach dispenser, fabric softener dispenser, sound insulation, and end of cycle signal.
6. Finish: Painted steel, color white.
7. Provide one (1) Accessible washer, minimum; Front-loading with front-mounted controls.
8. Manufacturers:
   a. To be selected by Owner.

C. Clothes Dryer: Electric, Commercial Grade; Coin-operated.
1. Size: Large capacity.
2. Controls: Solid state electronic, with temperature-sensing dry control.
3. Temperature Selections: Four.
4. Cycles: Include normal, permanent press, knit/delicate, and air only.
5. Features: Include interior light, reversible door, sound insulation, and end of cycle signal.
6. Finish: Painted steel, color white.
7. Provide one (1) Accessible dryer, minimum; with front-mounted controls.
8. Manufacturers:
   a. To be selected by Owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

A. All appliances to be installed in locations as shown on Drawings.

B. Install in accordance with manufacturer's instructions.

C. Coordinate installation/operating dimensions/clearances for all appliances with Millwork Cabinetry layouts.

D. Provide all installation hardware, accessories kits, and power cords as required for complete installation of each appliance.

E. Anchor built-in equipment in place.

3.03 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.04 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

3.05 CLOSE OUT

A. Operating Manuals for each appliance shall be left in the individual Dwelling Units and Community Building kitchen respectively, unless directed otherwise.

B. Warranty registration information shall be turned over to Owner upon completion of installation.

END OF SECTION

SECTION 11 68 13
PLAYGROUND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Playground layout (staking).

B. Playground equipment.

C. Protective Ground cover.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2009 (Reapproved 2014).

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

D. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing; 2015.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

G. ASTM D3363 - Standard Test Method for Film Hardness by Pencil Test; 2005 (Reapproved 2011).

H. ASTM D6662 - Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards; 2013.

I. ASTM F1487 - Standard Consumer Safety Performance Specification for Playground Equipment for Public Use; 2011.

J. ASTM F2075 - Standard Specification for Engineered Wood Fiber for Use as a Playground Safety Surface Under and Around Playground Equipment; 2015.

K. CPSC Pub. No. 325 - Public Playground Safety Handbook; 2010.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Convene a meeting one week before starting earthwork for playground to discuss coordination between various installers.
   1. Require attendance by personnel responsible for grading and installers of playground equipment, protective surfacing, footings, and adjacent work.
   2. Include representatives of Contractor.
   3. Notify Architect at least 2 weeks prior to meeting.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: For manufactured equipment, provide manufacturer's product data showing materials of construction, compliance with specified standards, installation procedures, safety limitations, and the number of users permitted.

C. Shop Drawings: Detailed scale drawings showing play event layout, Use Zone perimeters, and fall height for each play event.
   1. Show locations and dimensions of footings and anchorage points.
   2. Clearly identify mounting elevations in relation to a fixed survey point on site and to subgrade elevation and depth of protective surfacing.
   3. Show locations of underground utilities, storm drainage system and irrigation system.
   4. Show locations of related construction such as walkways and roadways, fences, site furnishings, and plantings.

D. Samples: For each item that a color must be selected, provide color chart showing full range of colors and finishes.

E. Maintenance Data: Provide manufacturer's recommended maintenance instructions and list of replaceable parts for each equipment item, with address and phone number of source of supply.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company regularly engaged in manufacturing materials and products specified in this section, with not less than three years of experience.

B. Installer Qualifications: Company certified by manufacturer for training and experience installing play events and equipment.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store equipment to project site in accordance with manufacturer's recommendations.

B. Store materials in a dry, covered area, elevated above grade.

1.07 WARRANTY

A. Provide manufacturer's standard Limited Lifetime Warranty for playground equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Playground Equipment:
   1. GameTime, Inc: www.gametime.com.
   2. Landscape Structures, Inc: www.playlsi.com.
   3. Park Structures, Inc: www.parkstructures.com.

2.02 PLAYGROUND EQUIPMENT - GENERAL

A. Design Assumptions: Because the safety of the playground depends on strict compliance with design criteria, this information is provided for Contractor's information.
   1. Provide four (4) pieces, plus multiple-play structure.
      a. Provide layout and specifications from manufacturer for Owner's approval.
   2. Playground is to be designed for children ages 5 through 12.
   3. Access by wheelchair into playground area is not required.
   4. If deviations from specified dimensions, especially fall heights, is required, obtain approval prior to proceeding; follow approval request procedure as specified for substitutions.

B. Mount equipment on concrete footings, unless otherwise indicated.
   1. Playground protective surfacing constitutes a resilient layer installed over subgrade; locate top of footings and anchorage devices below surface of subgrade.
   2. Provide supports as required to mount equipment at proper height above finish and sub-grades to allow installation of sufficient depth of protective surfacing; portion of support below top of surfacing must comply with specified requirements for equipment.

2.03 PLAYGROUND EQUIPMENT

A. Comply with ASTM F1487 and CPSC Pub. No. 325; provide equipment complying with specified requirements for relevant age group(s).
   1. Provide components having factory-drilled holes; do not use components with extra holes that will not be filled by hardware or covered by other components.

B. Single-Axis (To-and-Fro) Swings: Single-user swings seats suspended from steel chains.
   1. Location: As indicated on drawings.
   2. Seats - Ages Five to Twelve: Standard swing seat molded of rubber or polyurethane with encapsulated steel reinforcement. Provide two swings for each swing bay.
   3. Height to Pivot Point - Ages Five to Twelve: 84 inches.

C. Spring Rockers: Designed for seated riders, maximum weight limit 120 pounds, seats designed to accommodate intended number of users only.
   1. Fall Height: 24 inches.
   2. Material: steel with fiberglass shell.
   3. Color: Select from manufacturer's standard color palette.

D. Slides: Slide bed, stair with handrails, and platform.
   1. Slide Bed: Rigid, molded ultraviolet stabilized polyethylene.
   2. Treads and Handrails: Galvanized steel with stringers of galvanized steel.
   3. Fall Height - Ages Five to Twelve: 60 inches, maximum.
   4. Width: 14 inches.
   5. Maximum Slope: 1:3.4.
   6. Supports and Platform: Galvanized steel with PVC coating.
   7. Color: As selected from manufacturer's standard color palette.

2.04 CUSTOM PLAY STRUCTURES

A. Materials, Configuration, and Dimensions: As indicated on shop drawings.

B. Fabricate in accordance with ASTM F1487, unless otherwise indicated; in particular, requirements for sharp points and edges, protrusions, entanglement hazards, crush and shear points, and head and neck entrapment.

C. Stairs and Ship's Ladders: Treads and handrails of vinyl-coated steel and stringers of vinyl-coated steel.

D. Ladders: Stringers of vinyl-coated steel with rungs of vinyl-coated steel, secured to prevent turning.

E. Sliding Poles: Hot-dipped galvanized steel pipe, 1.9 inch diameter, maximum; continuous surface with no protruding welds or joints along the sliding area.

F. Flexible Climber: Flexible grid of cables to provide access to an elevated platform; anchored at both ends; ground anchor below bottom of protective surfacing.

2.05 MATERIALS

A. Steel Pipe and Tube: Comply with ASTM A135/A135M, ASTM A500/A500M, or ASTM A513/A513M; hot-dipped galvanized and free of excess weld and spatter.
   1. Tensile Strength: 45,000 psi, minimum.
   2. Yield Point: 33,000 psi, minimum.
   3. Galvanizing: Hot-dip metal components in zinc after fabrication, in accordance with ASTM A123/A123M; remove tailings and sharp protrusions and burnish edges.

B. Extruded Aluminum: ASTM B221 or ASTM B221M, Alloy 6061, 6062, or 6063.
   1. Tensile Strength: 39,000 psi, minimum.
   2. Yield Point: 36,500 psi, minimum.

C. Chain: Corrosion resistant zinc plated steel; minimum size 4/0; polyvinyl chloride (PVC) coating.

D. Rope Cable: Strands of steel cable with UV-stabilized polypropylene synthetic covering; ends capped to prevent fraying.

E. Hardware: Provide without hazardous protrusions, corners, or finishes, and that require tools for removal after installation; countersunk fasteners are preferred.
   1. Use stainless steel for metal-to-metal connections; select type to minimize galvanic corrosion of materials connected by hardware.
   2. Use stainless steel with plastic components.
   3. Bearings: Self lubricating.
   4. Hooks, Including S-Hooks: Closed loop; maximum gap 0.04 inches, less than the thickness of a dime.
   5. Rails, Loops, and Hand Bars: Same metal as item is mounted on or galvanized steel; with polyvinyl chloride coating.
   6. Anchors: In accordance with manufacturer's recommendations.

F. Transparent Plastic: Clear polycarbonate plastic sheets, flat; shatterproof; resistant to crazing, cracking, and fogging.
   1. Sheet Thickness: 3/16 inch, minimum.

G. Opaque Plastic: Molded homogeneous plastic; do not use plastic as major load bearing members; use as panels and railings is acceptable.
   1. Homogeneous Plastic: Ultraviolet (UV) and color stabilized polyethylene without applied surface coating; color through entire thickness.
   2. Wood-Polymer Composite Lumber: Comply with ASTM D6662; factory finished.
   3. Panel Thickness: 3/16 inch, minimum.
   4. Panel Edges: 3/16 inch radius, minimum.

H. Polyvinyl Chloride (PVC) Coating: Ultraviolet (UV) stabilized and mold-resistant; slip-resistant finish; prime parts to be coated with clear acrylic thermosetting solution, and preheat prior to dipping in liquid PVC.
   1. Thickness: 0.08 inch, minimum, plus/minus 0.02 inch.
   2. Hardness: 85 durometer, when tested in accordance with ASTM D3363.

I. Concrete: As specified in Section 03 30 00.

2.06 PROTECTIVE GROUND COVER

A. Engineered Wood Fiber Fill: Manufactured for the purpose of protective surfacing; complying with ASTM F2075; do not use mulch manufactured from recycled pallets, or lumber containing nails or metal fasteners.
   1. Depth - Other Than High Play Activity Area: 9 inches, maximum.
   2. Depth - High Play Activity Area: 12 inches.
   3. Manufacturers:
      a. Fibar Systems: www.fibar.com.
      b. GameTime, Inc: www.gametime.com.
      c. Sof' Fall: www.sof-fall.com.

B. Geotextile Fabric: Nonwoven polypropylene sheet.

C. Containment Edging: Manufacturer's standard molded, interlocking High-density polyethylene, UV stabilized, free of sharp vertical edges, protruding elements, and trip hazards, complete with installation hardware.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that playground area has been graded to subgrade elevations required and that excess soil, rocks, and debris have been removed.

B. Verify that playground equipment footings have been installed in proper locations and at proper elevations.

C. Verify location of underground utilities and facilities in playground area; damage to underground utilities and facilities will be repaired at Contractor's expense.

3.02 PREPARATION

A. Stake location of playground elements, including Use Zone perimeters, perimeter of protective surfacing, access and egress points, hard surfaces, walls, fences, and structures, and planting locations.

3.03 INSTALLATION

A. Install in accordance with CPSC Pub. No. 325, ASTM F1487, manufacturer's instructions, and requirements of authorities having jurisdiction (AHJ).

B. Anchor equipment securely below bottom elevation of resilient surfacing layer.

C. Install without sharp points, edges or protrusions, entanglement hazards, pinch, crush, or shear points.

D. Do not modify play events on site without written approval of manufacturer.

E. Install required signage if not factory-installed.

F. Protective Ground Cover:

1. Install in accordance with CPSC Pub. No. 325 and ASTM F1487, and requirements of authorities having jurisdiction.
2. Cover subgrade with geotextile fabric:
    a. Lap minimum 4 inches width at seams. Adhere seams in accordance with manufacturer's recommendations.
    b. Install fabric smooth, and free of tensile stresses, folds, or wrinkles.
    c. Protect fabric from clogging, tears, or other damage during surfacing installation.
    d. Repair or replace damaged fabric in accordance with manufacturer's recommendations.
3. Install loose fill to depths indicated, with smooth even surface flush with tops of containment curbs.

3.04 CLEANING

A. Restore adjacent existing areas that have been damaged from the construction.

B. Clean playground equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation; clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.

C. Clean playground area of excess construction materials, debris, and waste.

D. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction (AHJ).

3.05 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 12 21 13
HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal PVC faux-wood slat louver blinds.

B. Operating hardware.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics and operating features.

C. Manufacturer's Installation Instructions: Indicate special procedures.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds:
   1. CACO Inc.: www.cacoinc.com
   2. SWFcontract, a division of Spring Window Fashions, LLC.: www.swfcontract.com.
      a. Bali Blinds.
      b. Graber Blinds

2.02 BLINDS

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.
   1. Provide 2 inch 'Faux-Wood' horizontal louver blinds at all Dwelling Unit windows.
   2. Provide 2 inch 'Faux-Wood' horizontal louver blinds at all Common Area windows.

B. Manual Operation: Control of raising and lowering by counterbalance spring with full range locking; blade angle adjustable by control wand.

C. Plastic Slats: Extruded PVC, square slat corners.
   1. Width: 2 inch.
   2. Thickness: 0.10 inch.
   3. Color: As selected by Owner.
   4. Texture: Simulated wood-grain.

D. Slat Support: Woven polypropylene cord, ladder configuration.

E. Head Rail: Pre-finished, formed steel box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
   1. Height: 1 inches.
   2. Color: Same as slats.

F. Bottom Rail: Pre-finished, formed steel ; with end caps.
   1. Color: Same as headrail.

G. Control Wand: Extruded solid plastic; hexagonal shape.
   1. Length of window opening height less 3 inch.

H. Headrail Attachment: Wall brackets.

I. Accessory Hardware: Type recommended by blind manufacturer.

2.03 FABRICATION

A. Fabricate blinds to fit within openings with uniform edge clearance of 1/8 inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed. See Section 06 10 00.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with concealed fasteners.

C. Install intermediate head supports at midpoint of double windows.

3.03 ADJUSTING

A. Adjust blinds for smooth operation.

3.04 CLEANING

A. Clean blind surfaces just prior to occupancy.

END OF SECTION

SECTION 12 35 30
RESIDENTIAL CABINETS AND COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Kitchen cabinets.

B. Kitchen countertops.

C. Vanity cabinets.

D. Vanity countertops.

E. Epoxy resin window sills.

F. Miscellaneous Work Surfaces.

1.02 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.

C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.

F. KCMA A161.1 - Performance and Construction Standard for Kitchen and Vanity Cabinets; 2012.

G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

H. UFAS - Uniform Federal Accessibility Standards - HUD 24 CFR part 40; 1984.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, configurations, and construction details.

C. Certificate: Submit Kitchen Cabinet Manufacturers Association (KCMA) certificate showing conformance with KCMA A161.1.

D. Shop Drawings: Indicate casework locations, scale plans, elevations, clearances required, rough-in and anchor placement dimensions and tolerances, and color samples.

E. Manufacturer's Qualification Statement.

F. Warranty: Manufacturer's warranty for all items provided under this section.
   1. Cabinets: Manufacturer's standard 1 year warranty.
   2. Acrylic or Acrylic/Polyester Vanity Countertop: Manufacturer's 10 year warranty against defects.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 CABINETS

A. Manufacturers:
   1. American Traditions/S&W Cabinets, Inc; Shaker Poplar: www.swcabinets.com

2. Mid-America Cabinets Inc; "Sierra/Mesa" : www.midamericacabinets.com.
3. Wellborn Cabinet, Inc; Home Concepts - All Plywod: www.wellborn.com.
4. Wolf Home Products; Wolf Classic Cabinets: www.wolfhomeproducts.com.
5. Or approved equal.

B. Kitchen and Vanity Cabinets: Premanufactured and factory-finished, complying with construction and testing requirements in KCMA A161.1.

C. Cabinet Box: Framed construction.
1. Side Panels: 5/8 inch Plywood.
a. Exposed Side Panel Finish: Hardwood veneer, coordinate with cabinet door and drawer color/finish.
2. Back Panel: 1/4 inch Plywood.
3. Bottom (and Top) Panel: 1/2 inchPlywood, dadoed into side panels and interlocked with hanging rail.
4. Face Frame: 3/4 inchkiln-dried hardwood, screwed and glued.
5. Interior Cabinet Finish: Thermally fused laminate.
6. Exposed Panel Edges: Finish with manufacturer's standard edge banding, color coordinated with other exposed finishes.
7. Extend base and upper cabinets, and shelves into corners, typical.

D. Cabinet Door/Drawer Configuration: Partial overlay.

E. Cabinet Doors:
1. Solid wood, stained finish.
2. 3/4 inch kiln-dried hardwood frame; mortice and tenon construction, 1/4 inch plywood center panel with hardwood veneer finsh.
3. Stain Color: As selected by Owner.

F. Drawers:
1. 1/2 inch Birch plywood full box with butted joints, 1/4 inch Birch plywood bottom.
2. Drawer Front: 3/4 inch kiln-dried hardwood.
3. Interior Finish: Manufacturer's standard.

G. Shelves: 5/8 inch plywood.
1. Exposed shelf edges: Finish with manufacturer's standard edge banding, color coordinated with other exposed finishes.

H. Cabinet Hardware: As selected from manufacturer's standard types, styles and finishes.
1. Drawer and Cabinet Pulls: Satin nickel, wire pulls 4 inches wide
a. Hardware to comply with accessibility requirements of UFAS, and ADA Standards where applicable.
2. Hinges: Manufacturer's standard self-closing concealed hinges.
3. Drawer Slides: Manufacturer's premium self-closing drawer slides.
a. Full extension, ball-bearing slides; side-mount.
b. Dynamic load rating: 100 pounds, minimum.

I. Exterior Finish: Factory-applied urethane; 2 color coats with top coat min.
1. Color: To be selected by Owner from manufacturer's standard line.

2.02 COUNTERTOPS

A. Kitchen Countertops and all Countertops in Common Areas: Post formed plastic laminate over particle board with, rolled edge, and coved to back splash.
1. Side Splash: Plastic laminate over particle board, square internal intersections to back splash and top surface, contoured to suit counter top profile, and of equal height.
a. Provide side splash where end of countertops abut partitions/endwalls.
2. Colors/Patterns: To be selected by Owner from manufacturer's standard line.

B. Vanity Countertops: Post formed plastic laminate over particle board, coved to back splash.
1. Side Splash: Plastic laminate over particle board, square internal intersections to back splash and top surface, contoured to suit counter top profile.
a. Provide side splash where end of countertops abut partitions/endwalls.
2. Colors/Patterns: To be selected by Owner from manufacturer's standard line.

2.03 WINDOW SILLS

A. Natural Quartz and Resin Composite Window Sills (Cultured Marble): Sheet or slab of natural quartz and plastic resin.
   1. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   2. Flat Sheet Thickness: 3/4 inch, minimum.
   3. Finish on Exposed Surfaces: Polished.
   4. Color and Pattern: As selected by Owner.

2.04 MATERIALS

A. Adhesives Used for Assembly: Comply with VOC requirements for adhesives and sealants as specified in Section 01 61 16.

B. Wood-Based Materials:
   1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.

C. Solid Wood: Clear, dry, sound, plain sawn, selected for species grain and color, no defects.

D. Hardwood Plywood: Veneer core; HPVA HP-1 Grade as indicated; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.

E. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.

F. Particleboard: Composed of wood chips, medium density, with waterproof resin binders; of grade to suit application; sanded faces; complying with ANSI A208.1.

G. Medium Density Fiberboard (MDF): Composed of cellulosic fibers and resin cured under heat and pressure; grade to suite application; complying with ANSI A208.2.

H. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.

2.05 FABRICATION

A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

B. Fabricate corners and joints without gaps.

C. Fabricate each unit to be rigid and not dependent on adjacent units for rigidity.

D. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1/2 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
   4. Finish all exposed ends of countertops, including ends abutting appliances.

E. When necessary to cut and fit countertops on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

F. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.

G. Wall-Mounted Counters: Provide aprons, brackets, and braces as indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of support framing.

3.02 INSTALLATION

A. Install casework, components and accessories in accordance with manufacturer's instructions.

B. Set casework items plumb and square, securely anchored to building structure.

C. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch.

3.03 CLEANING

A. Clean casework, countertops, shelves, and hardware.

3.04 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

END OF SECTION

SECTION 14 24 00
HYDRAULIC ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Complete hydraulic elevator systems.
   1. Passenger type.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:
      a. Elevator equipment devices remote from elevator machine room or hoistway.
      b. Telephone service for machine room.
      c. Elevator pit for lighting, sump pump, and convenience power.

B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
   1. Review schedule of installation, proper procedures and conditions, and coordination with related work.

C. Construction Use of Elevator: Not permitted.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit data on following items:
   1. Signal and operating fixtures, operating panels, and indicators.
   2. Car design, dimensions, layout, and components.
   3. Car and hoistway door and frame details.
   4. Electrical characteristics and connection requirements.

C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
   1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
   2. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.
   3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
   4. Clearances and over-travel of car.
   5. Locations in hoistway and machine room of traveling cables and connections for car lighting and telephone.
   6. Location and sizes of hoistway and car doors and frames.
   7. Electrical characteristics and connection requirements.
   8. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.

D. Samples: Submit samples illustrating car interior finishes, car and hoistway door and frame finishes, and handrail material and finish in the form of cut sheets or finish color selection brochures.

E. Testing Agency's Qualification Statement.

F. Initial Maintenance Contract.

G. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
   1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.

H. Operation and Maintenance Data:
   1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
   2. Operation and maintenance manual.

3. Schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and approved by elevator equipment manufacturer.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

D. Products Requiring Fire Resistance Rating: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.

E. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

1.05 WARRANTY

A. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hydraulic Elevator Manufacturers:
   1. Schindler Elevator Corporation; Model 330A: www.schindler.com.

2.02 HYDRAULIC ELEVATORS

A. Hydraulic Passenger Elevator:
   1. Hydraulic Elevator Equipment:
      a. Holeless hydraulic with cylinder mounted within hoistway.
   2. Drive System:
      a. Variable voltage variable frequency (VVVF) to modulate motor speed.
   3. Operation Control Type:
      a. Selective Collective Automatic Operation Control.
   4. Service Control Type:
      a. Standard service control only.
      b. Independent service control.
   5. Interior Car Height: 96 inch.
   6. Electrical Power: 208 volts; alternating current (AC); three phase; 60 Hz.
   7. Rated Net Capacity: 3000 pounds.
   8. Rated Speed: 150 feet per minute.
   9. Hoistway Size: As indicated on drawings.
   10. Interior Car Platform Size: As indicated on drawings.
   11. Elevator Pit Depth: 60 inch.
   12. Overhead Clearance at Top Floor: 144 inch.
   13. Travel Distance: As indicated on drawings.
   14. Number of Stops: 4.
   15. Number of Openings: 4 Front.
   16. Hydraulic Equipment Location: Adjacent to bottom of hoistway shaft

2.03 COMPONENTS

A. Elevator Equipment:
   1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70.
   2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
   3. Buffers:

a. Spring type for elevators with speed less than or equal to 200 fpm.

4. Lubrication Equipment:
   a. Provide grease fittings for periodic lubrication of bearings.
   b. Grease Cups: Automatic feed type.
   c. Lubrication Points: Visible and easily accessible.

B. Electrical Equipment:
   1. Motors: NEMA MG 1.
   2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70; see Section 26 05 33.
   3. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.
   4. Include wiring and connections to elevator devices remote from hoistway and between elevator machine room. Provide additional components and wiring to suit machine room layout.

2.04 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).

B. Accessibility Requirements: Comply with UFAS and ADA Standards.

C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.

D. Comply with seismic design requirements in accordance with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
   1. Complying with Elevator Safety Requirements for Seismic Risk Zone in accordance with ASME A17.1, ASCE 7 and other related requirements.

E. Perform welding of steel in accordance with AWS D1.1/D1.1M.

F. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.

G. Perform electrical work in accordance with NFPA 70.

H. Comply with venting or pressurization of hoistway design in accordance with HVAC system requirements and authorities having jurisdiction (AHJ).

I. Comply with fire protection sprinkler system of hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction (AHJ). See Section 21 13 13.

2.05 OPERATION CONTROLS

A. Elevator Controls: Provide landing operating panels and landing indicator panels.
   1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
   2. Landing Indicator Panels: Illuminating.
   3. Comply with UFAS and ADA Standards for elevator controls.

B. Interconnect elevator control system with building fire alarm and smoke alarm systems.

C. Door Operation Controls:
   1. Program door control to open doors automatically when car arrives at floor landing.
   2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
   3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

D. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, and authorities having jurisdiction (AHJ).

2.06 OPERATION CONTROL TYPE

A. Selective Collective Automatic Operation Control: Applies to car in single elevator shaft.
   1. Refer to description provided in ASME A17.1.
   2. Automatic operation by means of one button in the car for each landing served and by "UP" and "DOWN" buttons at the landings.
   3. Stops are registered by momentary actuation of landing car buttons without consideration of the number of buttons actuated or the sequence buttons are actuated, but the stops are made in the order that landings are reached in each direction of travel.

4. All "UP" landing calls are made when car is traveling in the up direction.
5. All "DOWN" landing calls are made when car is traveling in the down direction.
6. Uppermost and lowermost calls are answered as soon as they are reached without consideration of the car travel direction.

2.07 SERVICE CONTROL TYPE

A. Independent Service Control:
1. Provide key operated "Independent Service" on car operating panel. Key activation will remove that car from normal operation and cancel pre-registered car calls.
2. Car will respond to selected floor. Car will not respond to any calls from landing call buttons. Car will only respond to calls placed on the car operating panel. Doors will remain open at last landing requested. Doors will close with a constant pressure on "Door Close" button.
3. Key activation to normal operation will return car to normal operation.

2.08 EMERGENCY POWER

A. Elevator Emergency Power Supply: Supplied by battery backup; provide elevator system components as required for emergency power characteristics.

B. Emergency Lighting: As selected from manufacturers standard line.

C. Provide operational control circuitry for adapting the change from normal to emergency power.

D. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.09 MATERIALS

A. Steel Cylinder Casing: ASTM A139/A139M, Grade A steel.

B. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.

C. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

D. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.

E. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.

F. Plywood: PS 1, Structural I, Grade C-D or better, sanded.

G. Tempered Glass: 3/8 inch minimum thickness, fully tempered in compliance with ASME A17.1, 16 CFR 1201, ANSI Z97.1, and ASTM C1048 tempered glass requirements.

H. Resilient Flooring: Vinyl tile flooring and Resilient base, see Section 09 65 00.

I. Plastic Laminate: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.

2.10 CAR AND HOISTWAY ENTRANCES

A. Elevator, No. 1:
1. Car and Hoistway Entrances, Main Elevator Lobby:
a. Hoistway Fire Rating: 1-1/2 Hours.
b. Framed Opening Finish and Material: Alkyd enamel on steel.
c. Car Door Material: Baked enamel on steel, with rigid sandwich panel construction.
d. Hoistway Door Material: Baked enamel on steel, with rigid sandwich panel construction.
e. Door Type: Double leaf.
f. Door Operation: Side opening, two speed.
g. Paint Color: As selected by Owner.
h. Door Width: 42 inches.
i. Door Height: 84 inches.
j. Sills: Extruded aluminum.

2.11 CAR EQUIPMENT AND MATERIALS

A. Elevator Car, No. 1:
1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open" button, "Door Close" button, and alarm button.

a. Panel Material: Integral with front return; one per car.
b. Car Floor Position Indicator: Above car operating panel with illuminating position indicators.
c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
d. Provide matching service cabinet integral with front return panel, with hinged door and keyed lock in each car.
e. Provide following within service cabinet as part of car operating panel:
1) Switch for each auxiliary operational control, keyed.
2) Switches for fan, light, and inspection control.
3) Emergency light.

2. Ventilation: Single speed fan with grille in ceiling.
3. Flooring: Resilient vinyl tile.
4. Wall Base: Resilient base, 4 inch high.
5. Front Return Panel: Baked enamel on steel.
6. Door Wall: Baked enamel on steel.
7. Side Walls: Baked enamel on steel.
8. Rear Wall: Baked enamel on steel.
9. Hand Rail: Aluminum, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
a. Aluminum Finish: Clear anodized.
10. Ceiling:
a. Canopy Ceiling: Plastic laminate on plywood.

B. Car Accessories:
1. Certificate Frame: Stainless steel frame glazed with tempered glass, and attached with tamper-proof screws.

2.12 MACHINE ROOM FITTINGS

A. Monitoring Device Interface:
1. Fabricate one multiple terminal block in controller relay panel or selector, in location indicated, for connection of monitoring devices for:
a. Landing and car registration circuits.
b. Motor generator running circuits.
c. Load weighing circuits.
d. Up and down peak programming circuits.
e. Independent service switches.
2. Label terminals for use with alligator test clips.

2.13 FINISHES

A. Baked Enamel on Steel: Clean and degrease metal surface; apply one coat of primer sprayed and baked; two coats of enamel sprayed and baked.

B. Finish Paint for Metal Surfaces: Alkyd enamel, semi-gloss, color as selected, complying with VOC limitations of authorities having jurisdiction (AHJ).

C. Clear Anodized Finish: Class I, AAMA 611 AA-M12C22A41, clear anodic coating with electrolytically deposited organic seal; not less than 0.7 mil, 0.0007 inch thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that hoistway, pit, and machine room are ready for work of this section.

C. Verify hoistway shaft and openings are of correct size and within tolerance.

D. Verify location and size of machine foundation and position of machine foundation bolts.

E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components.

B. Excavate for in-ground hydraulic cylinder casing and remove subsoil from site.

C. Maintain in-ground shaft alignment of 1/2 inch maximum from plumb.
   1. Fill over-excavated shaft depth with lean concrete.

D. Maintain elevator pit excavation free of water.

3.03 INSTALLATION

A. Coordinate this work with installation of hoistway wall construction.

B. Install system components, and connect equipment to building utilities.

C. Provide conduit, electrical boxes, wiring, and accessories; see Section 26 05 33.

D. Install hydraulic piping between cylinder and pump unit.

E. Mount machines, motors, and pumps on vibration and acoustic isolators.
   1. Place on structural supports and bearing plates.
   2. Securely fasten to building supports.
   3. Prevent lateral displacement.

F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.

G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.

H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.

I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.

J. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

K. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.

L. Adjust equipment for smooth and quiet operation.

3.04 TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.

B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Testing and inspection by regulatory agencies certified in accordance with ASME QEI-1 will be performed at their discretion.
   1. Schedule tests with agencies and notify Owner and Architect.
   2. Obtain permits as required to perform tests.
   3. Document regulatory agency tests and inspections in accordance with requirements.
   4. Perform tests required by regulatory agencies.
   5. Furnish test and approval certificates issued by authorities having jurisdiction.

C. Operational Tests:
   1. Perform operational tests in the presence of Owner and Architect.
   2. Test single elevator system by transporting at least 6 persons up from main floor to top floor landings during a five minute period.
   3. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
      a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.

3.06 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.

B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.07 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components in accordance with manufacturers written instructions.

3.08 PROTECTION

A. Do not permit construction traffic within car after cleaning.

B. Protect installed products until Date of Substantial Completion.

C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

END OF SECTION

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinklers.
4. Pressure gages.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which items of other systems and equipment are shown and coordinated with each other, using input from installers of the items involved.

B. Qualification Data: For qualified Installer **and professional engineer**.

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13D.
2. NFPA 13R.

B. Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Available fire-hydrant flow test records indicate the following conditions:
   a. Location of Residual Fire Hydrant R.
   b. Location of Flow Fire Hydrant F.
   c. Static Pressure at Residual Fire Hydrant R.
   d. Measured Flow at Flow Fire Hydrant F.
   e. Residual Pressure at Residual Fire Hydrant R.

2. Sprinkler system design shall be approved by authorities having jurisdiction.

END OF SECTION 211313

SECTION 220516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Alignment guides and anchors.
   2. Pipe loops and swing connections.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

2.2 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

   1. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.

B. Anchor Materials:

   1. Steel Shapes and Plates: ASTM A 36/A 36M.
   2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.

3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Stud: Threaded, zinc-coated carbon steel.
    b. Expansion Plug: Zinc-coated steel.
    c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least **five** pipe fittings, including tee in main.

C. Connect risers and branch connections to terminal units with at least **four** pipe fittings, including tee in riser.

D. Connect mains and branch connections to terminal units with at least **four** pipe fittings, including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install **two** guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than **four** pipe diameters from expansion joint.

C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:
    1. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.

END OF SECTION 220516

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.
4. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

A. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

2.2 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: **EPDM-rubber**, **High-temperature-silicone** interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: **Composite plastic, Stainless steel**.
5. Connecting Bolts and Nuts: **Stainless steel** of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.4 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide **1-inch** annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches** above finished floor level.

2. Using **grout or silicone sealant**, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078400 "Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than **NPS 6**: **Steel pipe sleeves**.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than **NPS 6**: **Steel pipe sleeves with sleeve-seal system**.

1) Select sleeve size to allow for **1-inch** annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than **NPS 6**: **Steel pipe sleeves with sleeve-seal system**.

1) Select sleeve size to allow for **1-inch** annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

   a. Piping Smaller Than **NPS 6**: **PVC pipe sleeves**.

5. Interior Partitions:

   a. Piping Smaller Than **NPS 6**: **PVC pipe sleeves**.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Steel Type: With **polished, chrome-plated** finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped **steel** with polished, chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

D. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; **concealed and exposed-rivet** hinge; and spring-clip fasteners.

2.2 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Chrome-Plated Piping: One-piece **steel or split-casting brass** with polished, chrome-plated finish.
c. Insulated Piping: One-piece steel with **polished, chrome-plated** finish.
d. Insulated Piping: One-piece stamped steel **or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge** with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with **polished, chrome-plated** finish.
f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel **or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge** with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with **polished, chrome-plated** finish.
h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel **or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge** with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 220518

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Types:
1. Handlever: For quarter-turn valves smaller than **NPS 4**.

G. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, One-Piece:
   1. Description:

      a. Standard: MSS SP-110.
      b. CWP Rating: 400 psig.
      c. Body Design: One piece.
      d. Body Material: Forged brass or bronze.
      e. Ends: Threaded and soldered.
      f. Seats: PTFE.
      g. Stem: Brass or stainless steel.
      h. Ball: Chrome-plated brass or stainless steel.
      i. Port: Reduced.

B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim:
   1. Description:

      a. Standard: MSS SP-110.
      b. CWP Rating: 600 psig.
      c. Body Design: Two piece.
      d. Body Material: Forged brass.
      e. Ends: Threaded and soldered.
      f. Seats: PTFE.
      g. Stem: Brass.
      h. Ball: Chrome-plated brass.
      i. Port: Full.

C. Brass Ball Valves, Two-Piece with Regular Port and Brass Trim:
   1. Description:

      a. Standard: MSS SP-110.
      b. CWP Rating: 600 psig.
      c. Body Design: Two piece.
      d. Body Material: Forged brass.
      e. Ends: Threaded and soldered.
      f. Seats: PTFE.
      g. Stem: Brass.
      h. Ball: Chrome-plated brass.
      i. Port: Regular.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.3 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. **Brass** Valves: May be provided with solder-joint ends instead of threaded ends.
2. **Brass** ball valve, one piece.
3. Brass ball valves, two-piece with **full** port and brass trim.

END OF SECTION 220523.12

SECTION 220523.14 - CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bronze swing check valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.18 for solder joint.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves with Bronze Disc, Class 125:
1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:
1. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: PTFE.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with **bronze or nonmetallic** disc.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze swing check valves **bronze or nonmetallic** disc, Class 125, with **soldered or threaded** end connections.

END OF SECTION 220523.14

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to **ASCE**.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of **carbon steel**.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of **copper-coated steel**.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: **ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig** minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: **Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig**] [**ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig** minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for **trapeze pipe hangers and equipment supports**.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to **1-1/2 inches**.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel **pipe hangers and supports and metal trapeze pipe hangers** and attachments for general service applications.

F. Use copper-plated pipe hangers and **copper** attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
5. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
6. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
7. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
8. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use **mechanical-expansion anchors** instead of building attachments where required in concrete construction.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping.
2. Domestic recirculating hot-water piping.
3. Storm-water piping exposed to freezing conditions.
4. Roof drains and rainwater leaders.
5. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Special-Shaped Insulation: ASTM C 552, Type III.
2. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
3. Preformed Pipe Insulation with Factory-Applied [**ASJ**] [**ASJ-SSL**]: Comply with ASTM C 552, Type II, Class 2.
4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

H. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
   1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
   1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
   2. Service Temperature Range: Minus 20 to plus 180 deg F.
   3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
   4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
   1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
   2. Service Temperature Range: Minus 20 to plus 180 deg F.
   3. Solids Content: 60 percent by volume and 66 percent by weight.
   4. Color: White.

2.5 SEALANTS

A. Joint Sealants for Cellular-Glass Products:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Permanently flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 100 to plus 300 deg F.
   4. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Adhesive: As recommended by jacket material manufacturer.
2. Color: **White**.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
1. **Sheet and roll stock ready for shop or field sizing**.
2. Finish and thickness are indicated in field-applied jacket schedules.
3. Moisture Barrier for Indoor Applications: **1-mil- thick, heat-bonded polyethylene and kraft paper**.
4. Moisture Barrier for Outdoor Applications: **3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick polysurlyn**.

5. Factory-Fabricated Fitting Covers:

   a. Same material, finish, and thickness as jacket.
   b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
   c. Tee covers.
   d. Flange and union covers.
   e. End caps.
   f. Beveled collars.
   g. Valve covers.
   h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 11.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 6.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Width: 2 inches.
   2. Thickness: 6 mils.
   3. Adhesion: 64 ounces force/inch in width.
   4. Elongation: 500 percent.
   5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   1. Width: 2 inches.
   2. Thickness: 3.7 mils.
   3. Adhesion: 100 ounces force/inch in width.
   4. Elongation: 5 percent.
   5. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, wide with **closed seal**.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: **0.080-inch nickel-copper alloy**.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:
1. Description: Manufactured plastic wraps for covering plumbing fixture **hot- and cold-water supplies** and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:
1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **2 inches** o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078400 "Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 "Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: **Two** finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to **three** locations of straight pipe, **three** locations of threaded fittings, **three** locations of welded fittings, **two** locations of threaded strainers, **two** locations of welded strainers, **three** locations of threaded valves, and **three** locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water: Insulation shall be **one of** the following:

1. Flexible Elastomeric: **3/4 inch** thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1/2 inch** thick.
3. Polyolefin: **3/4 inch** thick.

B. Stormwater and Overflow: Insulation shall be **one of** the following:

1. Flexible Elastomeric: **1 inch** thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1 inch** thick.
3. Polyolefin: **1 inch** thick.

C. Roof Drain and Overflow Drain Bodies: Insulation shall be[**one of**] the following:

1. Flexible Elastomeric: **1 inch** thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1 inch** thick.
3. Polyolefin: **1 inch** thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be[**one of**] the following:

1. Flexible Elastomeric: **1/2 inch** thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1/2** thick.
3. Polyolefin: **1/2 inch** thick.

E. Sanitary Waste Piping Where Heat Tracing Is Installed: Mineral-fiber, preformed pipe insulation, Type I, **1-1/2 inches** thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. **PVC**: **20 mils** thick.

D. Piping, Exposed:

1. None.
2. **PVC**: **20 mils** thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. PVC: **20 mils** thick.

3.16 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. PEX tube and fittings.
3. Piping joining materials.
4. Transition fittings.
5. Dielectric fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF Standard 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: **ASTM B 88, Type L** water tube, drawn temper.

B. Soft Copper Tube: **ASTM B 88, Type K** water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PEX TUBE AND FITTINGS

A. Tube Material: PEX plastic according to ASTM F 876 **and ASTM F 877**.

B. Fittings: **ASTM F 1807, metal insert and copper crimp rings** or **ASTM F 1960, cold expansion fittings and reinforcing rings**.

C. Fittings: ASSE 1061, push-fit fittings.

D. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 876; with plastic or corrosion-resistant-metal valve for each outlet.

2.4 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys.

B. Flux: ASTM B 813, water flushable.

C. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Standard: ASSE 1079.
2. Pressure Rating: **125 psig minimum at 180 deg F**.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

F. Install domestic water piping level and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install PEX tubing with loop at each change of direction of more than 90 degrees.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

R. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

S. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Joints for PEX Tubing: Join according to ASTM F 1807 for metal insert and copper crimp ring fittings and ASTM F 1960 for cold expansion fittings and reinforcing rings.

H. Joints for PEX Tubing: Join according to ASSE 1061 for push-fit fittings.

I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for **NPS 2** and Smaller: Use dielectric **couplings**.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:
    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Install vinyl-coated hangers for PEX tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.

H. Install hangers for vertical PEX tubing every 48 inches.

I. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components.

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping
1. Can-Tex Pressure Rated PVC Pipe with the Locked-in RSS Gasket Joint

E. Aboveground domestic water piping, **NPS 2 and smaller**, shall be the following:
1. PEX tube.

    a. Fittings for PEX tube:

        1) ASTM F 1807, metal insert and copper crimp rings.
        2) ASTM F 1960, cold expansion fittings and reinforcing rings.
        3) ASSE 1061, push-fit fittings.

END OF SECTION 221116

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: **10-foot head of water**.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

E. Adhesive Primer: ASTM F 656.

F. Solvent Cement: ASTM D 2564.

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C 1173.
    b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.
    d. Sleeve Materials:
        1) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
        2) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C 1460.
    b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; **2** percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: **2** percent downward in direction of flow.
3. Vent Piping: **1** percent down toward vertical fixture vent or toward vent stack.

M. Install aboveground PVC piping according to ASTM D 2665.

N. Install underground **PVC** piping according to ASTM D 2321.

O. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

3. Install drains in sanitary waste gravity-flow piping.

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

D. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: **Shielded**, nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.14 "Check Valves for Plumbing Piping," for general-duty valve installation requirements.

B. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves**.**
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in **Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."**

1. Install **carbon-steel** pipe hangers for horizontal piping in noncorrosive environments.
2. Install **carbon-steel** pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting**, valve,** and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for **PVC** piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.

F. Install supports for vertical **PVC** piping every 48 inches.

G. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves **in pit with pit cover flush with floor**.
6. Equipment: Connect waste piping as indicated.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed **PVC** Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Aboveground, soil and waste piping **NPS 4 and smaller** shall be the following:
   1. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.

B. Aboveground, vent piping **NPS 4 and smaller** shall be the following:
   1. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Underground, soil, waste, and vent piping **NPS 4 and smaller** shall be the following:
   1. **Solid wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 221316

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Residential, electric, storage, domestic-water heaters.
   2. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

B. Source quality-control reports.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex, "Drinking Water System Components - Health Effects."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.

a. Residential, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: **Five** years.
2) Controls and Other Components: **Two** years.

PART 2 - PRODUCTS

2.1 RESIDENTIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Residential, Electric, Storage, Domestic-Water Heaters:
1. Standard: UL 174.
2. Storage-Tank Construction: Steel.

a. Tappings: ASME B1.20.1 pipe thread.
b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: ASSE 1005.
d. Insulation: Comply with ASHRAE 90.2.
e. Jacket: Steel, cylindrical, with enameled finish.
f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
g. Heating Elements: Two; electric, screw-in immersion type; wired for nonsimultaneous operation unless otherwise indicated. Limited to 12 kW total.
h. Temperature Control: Adjustable thermostat.
i. Safety Control: High-temperature-limit cutoff device or system.
j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
2. Construction:

    a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    b. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics:

    a. Working-Pressure Rating: **100 psig**.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- maximum outlet pressure unless otherwise indicated.

F. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

G. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

I. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

J. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

K. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 for retesting and reinspecting requirements and for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Residential, Electric, Domestic-Water Heater Mounting: Install residential, electric, domestic-water heaters **on floor**.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping."

C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains.

E. Fill electric, domestic-water heaters with water.

F. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 for retesting and reinspecting requirements and for requirements for correcting the Work.

C. Prepare test and inspection reports.

END OF SECTION 223300

SECTION 224100 - RESIDENTIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bathtubs.
2. Faucets.
3. Lavatories.
4. Showers.
5. Kitchen sinks.
6. Laundry trays.
7. Dishwasher air-gap fittings.
8. Disposers.
9. Water closets.
10. Toilet seats.
11. Supply fittings.
12. Waste fittings.
13. See Plumbing Fixture Schedule on drawings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

See Plumbing Fixture Schedule on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install plumbing fixtures level and plumb according to roughing-in drawings.

B. Install floor-mounted water closets on closet flange attachments to drainage piping.

C. Install counter-mounting fixtures in and attached to casework.

D. Install pedestal lavatories on pedestals and secured to wood blocking in wall.

E. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball or gate valves if supply stops are not specified with fixture. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping."

F. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

G. Install toilet seats on water closets.

H. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

I. Install shower flow-control fittings with specified maximum flow rates in shower arms.

J. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes unless otherwise indicated.

K. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

L. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install **in sink deck**. Connect inlet hose to dishwasher and outlet hose to disposer.

M. Set **bathtubs and shower receptors** in leveling bed of cement grout.

N. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible **lavatories and sinks**. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

O. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

P. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.2 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible **lavatories and sinks**. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.4 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.

B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224100

SECTION 230548.13 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Elastomeric isolation mounts.
   2. Elastomeric hangers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:
   1. Mounting Plates:
      a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded **with threaded studs or bolts**.
      b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
   2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.2 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
   1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
   2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

PART 3 - EXECUTION

3.1 VIBRATION CONTROL DEVICE INSTALLATION

A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 230548.13

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Related Sections:
1. Section 230719 "HVAC Piping Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, **Type III with factory-applied FSK jacket**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a **2**-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

2.8 SECUREMENTS

A. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, **galvanized-steel** sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
   a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **2** o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078400 "Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 "Firestopping."

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for **100** percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch

o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for **100** percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078400 "Firestopping."

3.7 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: **Two** finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to **one** location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber **blanket**, **1-1/2 inches** thick and **3-lb/cu. ft.** nominal density.

B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber **blanket**, **1-1/2 inches** thick and **3-lb/cu. ft.** nominal density.

C. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber **blanket**, **1-1/2 inches** thick and **3-lb/cu. ft.** nominal density.

D. Exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber **blanket**, **2 inches** thick and **3-lb/cu. ft.** nominal density. R-9 minimum.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.

D. Ducts and Plenums, Exposed:

1. None.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, **Smooth**: **0.016 inch** thick.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:
   1. Refrigerant suction and hot-gas piping, **indoors and outdoors**.

B. Related Sections:

   1. Section 230713 "Duct Insulation."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail insulation application at pipe expansion joints for each type of insulation.
   3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   4. Detail removable insulation at piping specialties.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
2. Preformed Pipe Insulation with Factory-Applied **ASJ**: Comply with ASTM C 552, Type II, Class 2.
3. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

G. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
   1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
   2. Service Temperature Range: Minus 20 to plus 180 deg F.
   3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
   4. Color: White.

2.4 SEALANTS

A. Joint Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Permanently flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 100 to plus 300 deg F.
   4. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F.
   4. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F.
   4. Color: White.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
   4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
   5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

   6. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Adhesive: As recommended by jacket material manufacturer.
2. Color: **White**.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
1. **Sheet and roll stock ready for shop or field sizing**.
2. Finish and thickness are indicated in field-applied jacket schedules.
3. Moisture Barrier for Outdoor Applications: **3-mil- thick, heat-bonded polyethylene and kraft paper 2.5-mil- thick polysurlyn**.
4. Factory-Fabricated Fitting Covers:
    a. Same material, finish, and thickness as jacket.
    b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    c. Tee covers.
    d. Flange and union covers.
    e. End caps.
    f. Beveled collars.
    g. Valve covers.
    h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with **white** aluminum-foil facing.

F. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

G. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

H. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, **3/4 inch** wide with **wing seal or closed seal**.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: **0.080-inch nickel-copper alloy**.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **2 inches** o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation,

install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078400 "Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 "Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and

replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

D. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.10 FINISHES

A. Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: **Two** finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to **three** locations of straight pipe, **three** locations of threaded fittings, **three** locations of welded fittings, **two** locations of threaded strainers, **two** locations of welded strainers, **three** locations of threaded valves, and **three** locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: **Flexible elastomeric**, **1 inch** thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing: **Flexible elastomeric**, **1 inch** thick.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be **one of** the following:

1. Cellular Glass: **2 inches** thick.

2. Flexible Elastomeric: **2 inches** thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be the following:

1. Flexible Elastomeric: **2 inches** thick.

END OF SECTION 230719

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.
3. Refrigerants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.

B. Shop Drawings:

1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
2. Show interface and spatial relationships between piping and equipment.
3. Shop Drawing Scale: **1/4 inch equals 1 foot**.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: **ASTM B 280, Type ACR**.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8/A5.8M.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

B. Thermostatic Expansion Valves: Comply with AHRI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: **40 deg F**.
6. Superheat: **Adjustable**.

7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: **700 psig**.

C. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

D. Moisture/Liquid Indicators:
1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in parts per million (ppm).
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

E. Replaceable-Core Filter Dryers: Comply with AHRI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated **alumina**.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: **2 psig**.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with **brazed** joints.

B. Hot-Gas and Liquid Lines**, and Suction Lines for Heat-Pump Applications**: Copper, **Type ACR**, annealed- or drawn-temper tubing and wrought-copper fittings with **brazed** joints.

C. Safety-Relief-Valve Discharge Piping: Copper, **Type ACR**, annealed- or drawn-temper tubing and wrought-copper fittings with **brazed** joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install **diaphragm packless** valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install **diaphragm packless** valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve**, and in the suction line at the compressor**].

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

M. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

P. Identify refrigerant piping and valves.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:
1. Section 233300 "Air Duct Accessories" for dampers, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ANSI/ASHRAE 62.1.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.

9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DRYER EXHAUST DUCTS

A. Per 2018 IMC 504.2 and 603.4, shall be 4" rigid metal with one of the following:
   1. Firemaster "Dryerwrap" or equal
   2. 0.013" or thicker galvanized steel
   3. 0.018" galvanized aluminum

B. Use In-O-Vate "Dryer-Ell" or equal 10" radius smooth wall elbows for all turns.

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

   1. Galvanized Coating Designation: **G60**.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

   1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
   2. Tape Width: **3 inches**.
   3. Sealant: Modified styrene acrylic.
   4. Water resistant.
   5. Mold and mildew resistant.
   6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   7. Service: Indoor and outdoor.
   8. Service Temperature: Minus 40 to plus 200 deg F.
   9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
   10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal

flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.[**Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."**]

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
3. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
4. Unconditioned Space, Exhaust Ducts: Seal Class C.
5. Unconditioned Space, Return-Air Ducts: Seal Class B.
6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
7. Conditioned Space, Exhaust Ducts: Seal Class B.
8. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT CLEANING

A. Clean **new** duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.7 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel:

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps:

a. Pressure Class: Positive **1-inch wg**.
b. Minimum SMACNA Seal Class: **A**.
c. SMACNA Leakage Class for Rectangular: **12**.
d. SMACNA Leakage Class for Round and Flat Oval: **12**.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive **2-inch wg**.
b. Minimum SMACNA Seal Class: **A**.
c. SMACNA Leakage Class for Rectangular: **3**.
d. SMACNA Leakage Class for Round and Flat Oval: **3**.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps:

a. Pressure Class: Positive or negative **1-inch wg**.
b. Minimum SMACNA Seal Class: **A**.
c. SMACNA Leakage Class for Rectangular: **12**.
d. SMACNA Leakage Class for Round and Flat Oval: **12**.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative **2-inch wg**.
b. Minimum SMACNA Seal Class: **A**.
c. SMACNA Leakage Class for Rectangular: **6**.
d. SMACNA Leakage Class for Round and Flat Oval: **6**.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative **2-inch wg**.
b. Minimum SMACNA Seal Class: **A**.
c. SMACNA Leakage Class for Rectangular: **3**.
d. SMACNA Leakage Class for Round and Flat Oval: **3**.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative **1-inch wg**.
b. Minimum SMACNA Seal Class: **A** if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: **12**.
d. SMACNA Leakage Class for Round and Flat Oval: **6**.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative **2-inch wg**.
b. Minimum SMACNA Seal Class: **A** if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: **6**.
d. SMACNA Leakage Class for Round and Flat Oval: **3**.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps:

a. Pressure Class: Positive or negative **1-inch wg**.
b. Minimum SMACNA Seal Class: **A**.
c. SMACNA Leakage Class for Rectangular: **12**.
d. SMACNA Leakage Class for Round and Flat Oval: **6**.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

b. Round Elbows, **12 Inches** and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, **14 Inches** and Larger in Diameter: **Standing seam**.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Flange connectors.
7. Turning vanes.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Duct accessory hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: **G60**.

2. Exposed-Surface Finish: Mill phosphatized.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Description: Gravity balanced.

B. Maximum Air Velocity: **1000 fpm**.

C. Maximum System Pressure: **1-inch wg**.

D. Blades: Multiple single-piece blades, **center pivoted,** maximum 6-inch width, **0.025-inch-thick, roll-formed aluminum**.

E. Blade Action: Parallel.

F. Blade Seals: **Vinyl foam**.

G. Blade Axles:

1. Material: **Galvanized steel**.
2. Diameter: **0.20 inch**.

H. Tie Bars and Brackets: **Galvanized steel**.

I. Return Spring: Adjustable tension.

J. Bearings: **Steel ball or synthetic pivot bushings**.

K. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
    a. Sleeve Thickness: 20 gage minimum.
    b. Sleeve Length: 6 inches minimum.
6. Screen Mounting: Rear mounted.
7. Screen Material: **Galvanized steel**.
8. Screen Type: **Bird**.
9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
1. Standard leakage rating**, with linkage outside airstream**.
2. Suitable for horizontal or vertical applications.
3. Frames:

a. Frame: Hat-shaped, **0.094-inch- thick, galvanized sheet steel.**
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. **Galvanized**-steel, 0.064 inch thick.

5. Blade Axles: **Galvanized steel**.
6. Bearings:

a. **Oil-impregnated bronze**.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

2.5 CONTROL DAMPERS

A. Frames:

1. **Hat** shaped.
2. **0.094-inch- thick, galvanized sheet steel**.
3. **Mitered and welded** corners.

B. Blades:

1. Multiple blade with maximum blade width of **6 inches**.
2. **Opposed**-blade design.
3. **Galvanized-steel**.
4. **0.064 inch thick single skin or 0.0747-inch- thick dual skin**.
5. Blade Edging: **Closed-cell neoprene**.

C. Blade Axles: 1/2-inch- diameter; **galvanized steel**; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

D. Bearings:

1. **Oil-impregnated bronze**.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Type: **Static**; rated and labeled according to UL 555 by an NRTL.

B. Closing rating in ducts up to **4-inch wg** static pressure class and minimum **2000-fpm** velocity.

C. Fire Rating: **1-1/2** hours.

D. Frame: **Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream**; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: **0.05** thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, **0.024-inch-** thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Heat-Responsive Device: Replaceable, **165 deg** rated, fusible links.

2.7 FLANGE CONNECTORS

A. Description: **Add-on or roll-formed**, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

C. Vane Construction: **Single** wall.

2.9 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

    a. Double wall, rectangular.
    b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    c. Vision panel.
    d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
    e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

    a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
    b. Access Doors up to **18 Inches** Square: **Two hinges** and two sash locks.

2.10 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip **3-1/2 inches** wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install **backdraft** dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire dampers, to reset or reinstall fusible links. Access doors for access to fire dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream from turning vanes.
9. Control devices requiring inspection.
10. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.

K. Label access doors to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. Connect diffusers to ducts **directly or** with maximum **60-inch** lengths of flexible duct clamped or strapped in place.

N. Connect flexible ducts to metal ducts with **draw bands**.

O. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 233346 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulated flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For flexible ducts.

   1. Include plans showing locations and mounting and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."

D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 INSULATED FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; **polyethylene** vapor-barrier film.

   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.

2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-Value: **Comply with ASHRAE/IES 90.1**.

2.3 FLEXIBLE DUCT CONNECTORS

A. Clamps: **Nylon strap** in sizes 3 through 18 inches, to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.

C. Connect diffusers to ducts **directly or** with maximum **60-inch** lengths of flexible duct clamped or strapped in place.

D. Connect flexible ducts to metal ducts with **draw bands**.

E. Install duct test holes where required for testing and balancing purposes.

F. Installation:

1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.

G. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

END OF SECTION 233346

SECTION 233713.23 - REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adjustable blade face **registers**.
2. Fixed face **grilles**.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire dampers and volume-control dampers not integral to registers and grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 REGISTERS

A. Adjustable Blade Face Register:
1. Material: **Aluminum**.
2. Finish: **Baked enamel, white**.
3. Face Blade Arrangement: **Vertical** spaced **3/4 inch** apart.
4. Core Construction: **Integral**.
5. Rear-Blade Arrangement: **Horizontal** spaced **3/4 inch** apart.
6. Frame: **1-1/4 inches** wide.
7. Mounting: **Countersunk screw**.
8. Damper Type: **Adjustable opposed blade**.

2.2 GRILLES

A. Fixed Face Grille:
1. Material: **Aluminum**.
2. Finish: **Baked enamel, white**.
3. Face Blade Arrangement: **Horizontal**; spaced **3/4 inch** apart.
4. Core Construction: **Integral**.
5. Frame: **1-1/4 inches** wide.
6. Mounting: **Countersunk screw**.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 236200 – OUTDOOR HEAT PUMP UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes heat pump units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For compressor and condenser units. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Compressor failure.
b. Condenser coil leak.

2. Warranty Period (Compressor Only): **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 HEAT PUMPS

A. See HVAC Equipment Schedule on drawings.

B. Accessories:
1. **Electronic programmable thermostat**

2.2 SOURCE QUALITY CONTROL

A. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," Section 6, "Heating, Ventilating, and Air-Conditioning."

2.3 MXZ PORTED SYSTEM

A. General
1. The MXZ-C ported outdoor units shall be specifically designed to work with the wall mount, floor mount, ducted, 4-way ceiling recessed, 1-way ceiling recessed, ceiling suspended and multi-position air handler indoor unit types. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory prior to shipment.
2. If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor. Contractor responsible for ensuring alternative brand compatibility in terms of availability, physical dimensions, weight, electrical requirements, etc.
3. Outdoor unit shall have a sound rating no higher than 58 dB(A). If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
4. Refrigerant lines from the outdoor unit to the indoor units shall be insulated in accordance with the installation manual.
5. The outdoor unit shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.
6. The outdoor unit shall be capable of guaranteed operation in heating mode down to -13□F ambient temperatures and cooling mode up to 115□F without additional restrictions on line length & vertical separation beyond those published in respective product catalogs. Models with capacity data for required temperature range published as "for reference only" are not considered capable of guaranteed operation and are not acceptable. If an alternate manufacturer is selected, any additional material, cost, and labor to meet ambient operating range and performance shall be incurred by the contractor.
7. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized snow /hail guard. The snow/hail guard protects the outdoor coil surfaces from hail damage and snow build-up in severe climates.

8. Four-legged outdoor unit mounting systems shall be provided by manufacturer. Stand shall be made from 7 gauge plate steel with thermally fused polyester powder coat finish that meets ASTM D3451-06 standards. Stands shall be provided with galvanized mounting hardware and meets all ASCE 7 overturning safety requirement.

B. Unit Cabinet
1. The casing shall be fabricated of galvanized steel, bonderized, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. Assembly hardware shall be cadmium plated for weather resistance.
2. Cabinet color shall be Munsell 3Y 7.8/1.1.
3. Two (2) mild steel mounting feet, traverse mounted across the cabinet base pan, welded mount, providing four (4) slotted mounting holes shall be furnished. Assembly shall withstand lateral wind gust up to 155 MPH to meet applicable weather codes.

C. Fan
1. The unit shall be furnished with a direct drive, high performance propeller type fan.
2. The condenser fan motor shall be a variable speed, direct current (DC) motor and shall have permanently lubricated bearings.
3. Fan speed shall switch automatically according to the number of operating indoor units and the compressor operating frequency.
4. The fan motor shall be mounted with vibration isolation for quiet operation.
5. The fan shall be provided with a raised guard to prevent contact with moving parts.
6. The outdoor unit shall have horizontal discharge airflow.

D. Refrigerant and Refrigerant Piping
1. R410A refrigerant shall be required for systems.
2. Polyolester (POE) oil—widely available and used in conventional domestic systems—shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.
3. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the equipment manufacturer and installed in accordance with manufacturer recommendations.
4. All refrigerant piping must be insulated with ½" closed cell, CFC-free foam insulation with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. R value of insulation must be at least 3.
5. Refrigerant piping limits shall be in accordance with manufacturer specifications.

E. Coil
1. The outdoor unit coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil shall be protected with an integral guard.
3. Refrigerant flow from the outdoor unit to the indoor units shall be independently controlled by means of individual electronic linear expansion valves for each indoor unit.
4. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that

insulation will not contribute significantly to fire and up to 1" thick insulation shall have a Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.

5. All refrigerant connections between outdoor and indoor units shall be flare type.

F. Compressor

1. The compressor shall be a high performance, hermetic, inverter driven, variable speed, dual rotary type manufactured by Mitsubishi Electric Corporation.
2. The compressor motor shall be direct current (DC) type equipped with a factory supplied and installed inverter drive package.
3. The compressor will be equipped with an internal thermal overload.
4. The outdoor unit shall be equipped with a suction side refrigerant accumulator.
5. There shall be no need for line size changes. Filters, sight glasses, and traps shall not be used, and no additional refrigerant oil shall be required.
6. The compressor shall be mounted to avoid the transmission of vibration.

G. Basepan Heater

1. Each outdoor unit module shall be equipped with a basepan heater to protect the coil against ice build-up during prolonged winter operation. Basepan heater shall activate only if compressor is operating in heating mode at an outdoor ambient temperature of 36F or below.

H. Operating Range

1. Operating Range shall be in accord with the Table below

Operating Range		Indoor Intake Air Temp	Outdoor Intake Air Temp
Cooling	Maximum	95°F (35°C) DB, 71°F(21°C) WB	115°F (46°C) DB
	Minimum	67°F (19°C) DB, 57°F(14°C) WB	14°F (-10°C) DB
Heating	Maximum	80°F (27°C) DB, 67°F(19°C) WB	75°F (24°C) DB, 65°F(18°C) WB
	Minimum	70°F (21°C) DB, 60°F(16°C) WB	6°F (-14°C) DB, 5°F(-15°C) WB
			-12°F (-24°C) DB, -13°F(-25°C) WB*

I. Electrical

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.
3. The outdoor unit shall be controlled by the microprocessors located in the indoor unit and in the outdoor unit communicating system status, operation, and instructions digitally over A-Control – a system directing that the indoor unit be powered directly from the outdoor unit using a 3-wire, 14 gauge AWG connection plus ground.
4. The outdoor unit shall be equipped with Pulse Amplitude Modulation (PAM) compressor inverter drive control for maximum efficiency with minimum power consumption.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated.

B. Equipment Mounting:

1. Install heat pump units on cast-in-place concrete equipment bases.

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

C. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
2. Leak Test: After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Verify proper airflow over coils.

C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION 236200

SECTION 238219 – INDOOR HEAT PUMP UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes indoor heat pump units and accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale and coordinated with each other based on input from installers of the items involved:

B. Field quality-control reports.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-packaged and -tested units rated according to AHRI 440, ASHRAE 33, and UL 1995.

2.2 INDOOR HEAT PUMP UNITS

A. See HVAC Equipment Schedule

B. Electrical Connection: Factory wire motors and controls for a single electrical connection.

2.3 MSZ-GL WALL MOUNTED INDOOR UNIT

A. General
1. The wall-mounted indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet
1. All casings, regardless of model size, shall have the same white finish
2. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining are required.
3. There shall be a separate back plate which secures the unit firmly to the wall.

C. Fan
1. The indoor fan shall be statically and dynamically balanced to run on a single motor with permanently lubricated bearings.
2. An integral, motorized, multi-position, horizontal air sweep vane shall provide for uniform air distribution, up and down. Vane shall have 5 selectable positions plus AUTO (Controls position based upon mode, microprocessor shall automatically determine the vane angle to provide the optimum room temperature distribution) and SWING (Continuously moves up and down). In OFF mode the horizontal vane shall return to the closed position.
3. A motorized adjustable vertical guide vane shall be provided with the ability to change the airflow from side to side (left to right). Vane shall be positioned by a stepper motor driven by the indoor unit control microprocessor. Vane shall have 5 selectable positions and SWING (Continuously moves left and right).
4. The indoor unit shall include an AUTO fan setting capable of maximizing energy efficiency by adjusting the fan speed based on the difference between controller set-point and space temperature. The indoor fan shall be capable of six (6) speed settings, Quiet, Low, Med, High, Super High and Auto (2 ton unit does not have Quiet setting).

D. Filter
   1. Return air shall be filtered by means of two (2) easily removable, washable Nano Platinum Filters, and Electrostatic Anti-Allergy Enzyme Filters.

E. Coil
   1. The indoor unit coil shall be of nonferrous construction with smooth plate fins on copper tubing.
   2. The tubing shall have inner groves for high efficiency heat exchange.
   3. All tube joints shall be brazed with silver alloy.
   4. The coils shall be pressure tested at the factory.
   5. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil.
   6. A drain pan level switch (SS610E), designed to connect to the control board, shall be provided, if required, and installed in the condensate pan to prevent condensate from overflowing.

F. Electrical
   1. The unit electrical power shall be 208-230 volts, 1-phase, 60 hertz.
   2. The system shall be equipped with A-Control – a system directing that the indoor unit be powered directly from the outdoor unit using a 3-wire, 14 gauge AWG connections plus ground.
   3. The indoor unit shall not have any supplemental electrical heat elements.

G. Controls
   1. The unit shall include an IR receiver for wireless remote control flexibility
   2. The unit shall ship with a wireless handheld remote with the unit
   3. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install units to comply with NFPA 90A.

C. Verify locations of thermostats and other exposed control sensors with Drawings and room details before installation. Install devices **48 inches** above finished floor.

D. Install new filters in each unit within two weeks after Substantial Completion.

E. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

   1. Install piping adjacent to machine to allow service and maintenance.
   2. Connect condensate drain to indirect waste.

a. Install condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.

F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

C. Prepare test and inspection reports.

3.3 ADJUSTING

A. Adjust initial temperature set points.

END OF SECTION 238219

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with **ASTM B 8**.

D. Conductor Insulation:

1. Type NM: Comply with UL 83 and UL 719.
2. **Type USE-2 and Type SE**: Comply with UL 854.
3. **Type THHN and Type THWN-2**: Comply with UL 83.

4. **Type THW and Type THW-2**: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
5. Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Circuits:

1. [**Single circuit and multicircuit with color-coded conductors**.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

D. Conductors: **Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors**.

E. Ground Conductor: **Insulated**.

F. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.

G. Armor: **Steel**, interlocked.

H. Jacket: PVC applied over armor.

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: **Copper**.
2. Type: **Two** hole with **standard** barrels.
3. Termination: **Compression**.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Feeders: Copper for feeders smaller than No. 4 AWG. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

D. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

E. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: **Multiconductor cable, Type SE**.

B. Exposed Feeders: **Type THHN/THWN-2, single conductors in raceway** or **Metal-clad cable, Type MC**.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: **Nonmetallic-sheathed cable, Type NM**.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: **Type THHN/THWN-2, single conductors in raceway**.

E. Exposed Branch Circuits, Including in Crawlspaces: **Nonmetallic-sheathed cable, Type NM**.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: **Nonmetallic-sheathed cable, Type NM**.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: **Type THHN/THWN-2, single conductors in raceway**.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material **and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors**.

C. Wiring at Outlets: Install conductor at each outlet, with at least **12 inches** of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078400 "Firestopping."

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:
   1. Foundation steel electrodes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

   1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
      a. Ground rods.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: **Copper or tinned-copper** wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, **1/4 by 4 inches** in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless **compression**-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

G. Conduit Hubs: Mechanical type, terminal with threaded hub.

H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with **hex head bolt**.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Lay-in Lug Connector: Mechanical type, **copper rated for direct burial** terminal with set screw.

K. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

L. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

M. Straps: Solid copper, **copper lugs**. Rated for 600 A.

N. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; **3/4 inch by 10 feet**.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for **No. 8** AWG and smaller, and stranded conductors for **No. 6** AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, **No. 2/0** AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors.
3. Connections to Ground Rods: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

C. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, **and at individual ground rods**. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: **10** ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Conduit and cable support devices.
   2. Support for conductors in vertical conduit.
   3. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, and coordinated with each other, using input from installers of the items involved.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   1. Flame Rating: Class 1.
   2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Conduit and Cable Support Devices: **Steel** hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

B. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as

required to suit individual conductors or cables supported. Body shall be made of malleable iron.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 102.
4. NECA 105.
5. NECA 111.

B. Comply with requirements in Section 078400 "Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as **scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in** NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, **EMT** may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 078400 "Firestopping" for firestopping at conduit and box entrances.
2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. EMT: Comply with ANSI C80.3 and UL 797.

B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.
1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Fittings for EMT:

a. Material: **Steel**.
b. Type: **Setscrew or compression**.

4. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit

B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. ENT: Comply with NEMA TC 13 and UL 1653.

C. Nonmetallic Fittings:
1. Fittings, General: Listed and labeled for type of conduit, location, and use.
2. Fittings for ENT: Comply with NEMA TC 3; match to conduit or tubing type and material.
3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, **Type 1** or **Type 3R** unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

D. Solvents and Adhesives: As recommended by conduit manufacturer.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, **ferrous alloy**, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with UL Orange Book NEMA OS 2 and UL 514C.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

F. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: **4 inches square by 2-1/8 inches deep**.

J. Gangable boxes are **allowed**.

K. Cabinets:

1. NEMA 250, **Type 1** or **Type 3R** galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: **IMC or Type EPC-40-PVC**.
2. Concealed Conduit, Aboveground: **EMT** or **RNC, Type EPC-40-PVC**.
3. Underground Conduit: **Type EPC-40-PVC**.
4. Boxes and Enclosures, Aboveground: NEMA 250, **Type 3R**.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: **EMT** or **ENT**.
2. Exposed, Not Subject to Severe Physical Damage: **EMT**.
3. Exposed and Subject to Severe Physical Damage: **IMC**. Raceway locations include the following:

4. Concealed in Ceilings and Interior Walls and Partitions: **EMT or Type EPC-40-PVC**.

C. Minimum Raceway Size: **1/2-inch** trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use **setscrew or compression**, **steel** fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds **120 deg F**.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not fasten conduits onto the bottom side of a metal deck roof.

D. Keep raceways at least 6 inches away from parallel runs of flues hot-water pipes. Install horizontal raceway runs above water piping.

E. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

F. Arrange stub-ups so curved portions of bends are not visible above finished slab.

G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

I. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

J. Support conduit within 12 inches of enclosures to which attached.

K. Raceways Embedded in Slabs (NOT ALLOWED)

L. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

O. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Where otherwise required by NFPA 70.

R. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: **125 deg** temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: **155 deg F** temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: **125 deg F** temperature change.
    d. Attics: **135 deg F** temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of **72 inches** of flexible conduit for **recessed and semirecessed luminaires,** equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to **center** of box unless otherwise indicated.

U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Locate boxes so that cover or plate will not span different building finishes.

X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

Z. Set metal floor boxes level and flush with finished floor surface.

AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312316 "Excavation" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312323 "Fill."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31.
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.5 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078400 "Firestopping."

3.6 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: **120 deg F, material surfaces**.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. **Black letters on an orange field**.
2. Legend: Indicate voltage **and system or service type**.

B. Color-Coding for Phase- **and Voltage-Level** Identification, 600 V or Less

1. Color shall be factory applied **or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit**.
2. Colors for 208/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Colors for 240-V Circuits:

a. Phase A: Black.
b. Phase B: Red.

4. Colors for 480/277-V Circuits:

a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.

5. Color for Neutral: **White**.
6. Color for Equipment Grounds: **Green**.

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

D. Warning labels and signs shall include, but are not limited to, the following legends:
1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

E. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter and that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: **Preprinted**, 3-mil- thick, **vinyl** flexible label with acrylic pressure-sensitive adhesive.
   1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
   2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
   3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: **Vinyl**, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
   1. Minimum Nominal Size:
      a. 1-1/2 by 6 inches for raceway and conductors.
      b. 3-1/2 by 5 inches for equipment.
      c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameter and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around item being identified. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

C. Tape and Stencil: 4-inch- wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop stripes at legends.

D. Floor Marking Tape: 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with **black and white** stripes and clear vinyl overlay.

E. Underground-Line Warning Tape:

1. Tape:

   a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical **and communications** utility lines.
   b. Printing on tape shall be permanent and shall not be damaged by burial operations.
   c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2. Color and Printing:

   a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
   b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
   c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

3. Tag: **Type I**:

   a. Pigmented polyolefin, bright colored, compounded for direct-burial service.
   b. Width: 3 inches.
   c. Thickness: 4 mils.
   d. Weight: 18.5 lb/1000 sq. ft..
   e. Tensile according to ASTM D 882: 30 lbf and 2500 psi.

F. Stenciled Legend: In nonfading, waterproof, **black** ink or paint. Minimum letter height shall be **1 inch**.

2.6 TAGS

A. Write-on Tags:
1. Polyester Tags: **0.010 inch** thick, with corrosion-resistant grommet and cable tie for attachment.
2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 SIGNS

A. Baked-Enamel Signs:
1. Preprinted aluminum signs, **high-intensity reflective,** punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used.

L. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

M. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

1. "MAIN DISCONNECT #1."

N. Vinyl Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

O. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

P. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

Q. Self-Adhesive Labels:

1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

R. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

S. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

T. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

U. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

V. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

W. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

X. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
2. Limit use of underground-line warning tape to direct-buried cables.
3. Install underground-line warning tape for direct-buried cables and cables in raceways.

Y. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using **general-purpose, UV-stabilized**, or **plenum-rated** cable ties.

Z. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on minimum 1-1/2-inch- high sign; where two lines of text are required, use signs minimum 2 inches high.

AA. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes, manholes, and handholes, use **vinyl wraparound labels** to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use **write-on tags** with the conductor or cable designation, origin, and destination.

F. Control-Circuit Conductor Termination Identification: For identification at terminations, provide **self-adhesive wraparound labels** with the conductor designation.

G. Auxiliary Electrical Systems Conductor Identification: **Self-adhesive vinyl tape** that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

H. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

I. Workspace Indication: Apply **tape and stencil** to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

J. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: **Self-adhesive equipment labels**.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

a. Panels, disconnects.
b. Controls with external control power connections.

L. Operating Instruction Signs: **Self-adhesive labels**.

M. Equipment Identification Labels:

1. Indoor Equipment: **Self-adhesive label**.
2. Outdoor Equipment: **Laminated acrylic or melamine sign 4 inches high**.

END OF SECTION 260553

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. SPD: Surge protective device.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Include evidence of NRTL listing for SPD as installed in panelboard.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include wiring diagrams for power, signal, and control wiring.
9. Key interlock scheme drawing and sequence of operations.
10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 FIELD CONDITIONS

A. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: **12** months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: **Flush and Surface**-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, **Type 1**.
b. Outdoor Locations: NEMA 250, **Type 3R**.

2. Height: 84 inches maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

E. Incoming Mains Location: **Convertible between top and bottom**.

F. Phase, Neutral, and Ground Buses: **Tin-plated aluminum**.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: **Tin-plated aluminum**.
2. Main and Neutral Lugs: **Mechanical** type, with a lug on the neutral bar for each pole in the panelboard.

3. Ground Lugs and Bus-Configured Terminators: **Mechanical** type, with a lug on the bar for each pole in the panelboard.
4. Feed-Through Lugs: **Mechanical** type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: **Mechanical** type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

H. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

J. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.

K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: **Circuit breaker or lugs only**.

C. Branch Overcurrent Protective Devices: **Plug-in** circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

E. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with **series-connected rating, interrupting capacity** to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
3. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
4. Subfeed Circuit Breakers: Vertically mounted.

B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

2.4 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in **transparent card holder**.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to **NECA 407**.

C. Mount panelboard cabinet plumb and rigid without distortion of box.

D. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

F. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

G. Install filler plates in unused spaces.

H. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Straight-blade convenience receptacles.
2. GFCI receptacles.
3. SPD receptacles.
4. Toggle switches.
5. Residential devices.
6. Wall plates.

1.2 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Copper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

D. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.

E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

A. Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2.3 GFCI RECEPTACLES

A. General Description:

1. 125 V, 20 A, straight blade, [**feed**] [**non-feed**]-through type.
2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles:

C. Tamper-Resistant, Duplex GFCI Convenience Receptacles:

2.4 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole

2. Two Pole

3. Three Way

4. Four Way

2.5 RESIDENTIAL DEVICES

A. Residential-Grade, Tamper-Resistant Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.
   1. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.

B. Weather-Resistant and Tamper-Resistant Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.
   1. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.

C. Fan-Speed Controls:

   1. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters.
   2. Comply with UL 1917.
   3. Continuously adjustable **rotary knob, 1.5** A.
   4. Three-speed adjustable **rotary knob**, 1.5 A.

D. Arc-Fault Circuit-Interrupter Protection
   1. All dwelling units
   2. All 120 Volt, single phase, 15 and 20 ampere branch circuits supplying outlets and devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter, combination type, installed to provide protection of the branch circuit per NEC 210.12 (A)(1) through (6).

E. Tamper Resistant Receptacles
   1. In all dwelling units in areas specified in NEC 210.52 and 550.13
   2. All nonlocking-type 125 Volt, 15 and 20 ampere receptacles shall be listed tamper resistant receptacles

2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: **Smooth, high-impact thermoplastic 0.035-inch- thick**.
   3. Material for Unfinished Spaces: **Galvanized steel**.

4. Material for Damp Locations: **Thermoplastic** with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant**, thermoplastic** with lockable cover.

2.7 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: **As selected by Architect** unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles **up**, and on horizontally mounted receptacles to the **right**.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. GFCI Receptacles: Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.2 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. Tests for Convenience Receptacles:

a. Line Voltage: Acceptable range is 105 to 132 V.
b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
c. Ground Impedance: Values of up to 2 ohms are acceptable.
d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
e. Using the test plug, verify that the device and its outlet box are securely mounted.

f. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the LED luminaires as listed in the Lighting Fixture Schedule on the drawings.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, arranged by designation.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. **Use same designations indicated on Drawings.**

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:

B. Product Certificates: For each type of luminaire.

C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Standards:

1. ENERGY STAR certified.
2. UL Listing: Listed for damp location.
3. Recessed luminaires shall comply with NEMA LE 4.

C. CRI of **minimum 80**. CCT of **3000 K**.

D. Rated lamp life of **50,000** hours to L70.

E. Lamps dimmable from 100 percent to 0 percent of maximum light output.

F. Internal driver.

G. Nominal Operating Voltage: **120 V ac**.

1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

H. Housings:

1. **Extruded-aluminum** housing and heat sink.
2. **Clear powder-coat** finish.

2.2 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers, and Globes:

1. **Prismatic glass**
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. **Extruded-aluminum** housing and heat sink.
2. **Clear powder-coat** finish.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, **12 gage**.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports: Sized and rated for luminaire weight.

E. Flush-Mounted Luminaire Support: Secured to outlet box.

F. Wall-Mounted Luminaire Support:

1. **Attached to structural members in walls**.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with **two** 5/32-inch- diameter aircraft cable supports **adjustable to 120 inches in length**.
2. Ceiling mount with **pendant mount** with **5/32-inch-** diameter aircraft cable supports **adjustable to 120 inches in length**.
3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and **wire support** for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

K. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265119

SECTION 265613 - LIGHTING POLES AND STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Poles and accessories for support of luminaires.

1.2 DEFINITIONS

A. EPA: Equivalent projected area.

B. Luminaire: Complete luminaire.

C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

D. Standard: See "Pole."

1.3 ACTION SUBMITTALS

A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device.

B. Shop Drawings:

1. Include plans, elevations, sections, and **mounting and attachment** details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of **poles and pole accessories**.
4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
6. Method and procedure of pole installation. Include manufacturer's written installations.

1.4 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design.

B. Material test reports.

C. Field quality-control reports.

D. Sample warranty.

E. Soil test reports.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of **pole** that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.

1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01, to design pole foundation and pole power system.

B. Structural Characteristics: Comply with AASHTO LTS-6-M.

C. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.

D. Live Load: Single load of 500 lbf distributed according to AASHTO LTS-6-M.

E. Ice Load: Load of 3 lbf/sq. ft., applied according to AASHTO LTS-6-M for applicable areas on the Ice Load Map.

F. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.

1. Basic wind speed for calculating wind load for poles 50 feet high or less is **100 mph.**

a. Wind Importance Factor: **1.0**.
b. Minimum Design Life: **25 years**.
c. Velocity Conversion Factor: **1.0**.

G. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of **1.1** to obtain the EPA to be used in pole selection strength analysis.

H. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.2 ALUMINUM POLES

A. Poles: **Seamless**, extruded structural tube complying with ASTM B 221, Alloy 6061-T6, with access handhole in pole wall.

1. Shape: **Round, straight**.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Mast Arms: **Aluminum** type, continuously welded to pole attachment plate. Material and finish same as plate.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with **stainless**-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Grounding and Bonding Lugs: Bolted 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

F. Fasteners: **Stainless steel**, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

G. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

I. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I clear coating of 0.018 mm or thicker), complying with AAMA 611.

4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium; 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.

J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: **As selected by Architect from manufacturer's full range**.

K. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Powder coat shall comply with AAMA 2604.

    a. Electrostatic applied powder coating; single application with a minimum 2.5- to 3.5-mils dry film thickness; cured according to manufacturer's instructions. Coat interior and exterior of pole for equal corrosion protection.
    b. Color: **As selected by Architect from manufacturer's full range**.

2.3 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

B. Transformer-Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and to accept **indicated accessories**. Include removable flanged access cover secured with bolts or screws.

2.4 MOUNTING HARDWARE

A. Anchor Bolts: Manufactured to **ASTM F 1554, Grade 55,** with a minimum yield strength of 55,000 psi.

B. Nuts: ASTM A 563, Grade A, Heavy-Hex

C. Washers: ASTM F 436, Type 1.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 POLE FOUNDATION

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories.

1. Baseplate: Stamped with manufacturer's name, date of production, and cable entry.

3.2 POLE INSTALLATION

A. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

B. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.

C. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch-wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch below top of concrete slab.

D. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.

B. Steel Conduits: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.4 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground Nonmetallic Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundation.

END OF SECTION 265613

SECTION 265619 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

B. Related Requirements:

1. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For luminaire supports.

1. Include design calculations for luminaire supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale and coordinated.

B. Product Certificates: For each type of the following:

1. Luminaire.
2. Photoelectric relay.

C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.6 FIELD CONDITIONS

A. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.7 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **2** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1598 **and listed for wet location**.

E. Lamp base complying with **ANSI C81.61 or IEC 60061-1**.

F. CRI of **minimum 80**. CCT of **3000 K**.

G. L70 lamp life of **50,000** hours.

H. Nominal Operating Voltage: **240 V ac**.

I. In-line Fusing: **On the primary for each luminaire**.

J. Lamp Rating: Lamp marked for **outdoor use**.

K. Source Limitations: Obtain luminaires from single source from a single manufacturer.

L. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: **Corrosion-resistant aluminum**. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

2.3 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

    a. Color: **As selected by architect**.

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    a. Color: As selected by Architect from manufacturer's full range.

2.4 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:

1. **Attached to structural members in walls**.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. **Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.**

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming. **Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.**

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.2 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

B. Install on concrete base with top **12 inches** above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

    a. IES LM-5.
    b. IES LM-50.
    c. IES LM-52.
    d. IES LM-64.
    e. IES LM-72.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires **and photocell relays**.

END OF SECTION 265619

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.
4. Grounding rods.
5. Grounding labeling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:

1. Ground rods.
2. TGBs and routing of their bonding conductors.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Comply with UL 486A-486B.

B. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.

C. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmils, 14 strands of No. 17 AWG conductor, and 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.3 CONNECTORS

A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

B. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

C. Busbar Connectors: Cast silicon bronze, solderless **compression**-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch centers for a two-bolt connection to the busbar.

2.4 GROUNDING BUSBARS

A. TGB: Predrilled rectangular bars of hard-drawn solid copper, **1/4 by 2 inches** in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with TIA-607-B.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

B. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and

complying with TIA-607-B. Predrilling shall be with holes for use with lugs specified in this Section.

1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.

2.5 GROUND RODS

A. Ground Rods: **Copper-clad**; **3/4 inch by 10 feet** in diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of BCT connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1.

C. Comply with TIA-607-B.

3.3 APPLICATION

A. Conductors: Install solid conductor for **No. 8** AWG and smaller and stranded conductors for **No. 6** AWG and larger unless otherwise indicated.

1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than **No. 6** AWG.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Connections to Ground Rods: Bolted connectors.

C. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches.

D. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch intervals.
4. Install grounding and bonding conductors in 3/4-inch PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.

    a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 270528 "Pathways for Communications Systems," and bond both ends of the conduit to a TGB.

3.4 GROUNDING BUSBARS

A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches minimum from wall, 12 inches above finished floor unless otherwise indicated.

B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.5 CONNECTIONS

A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than **No. 6** AWG.

B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
2. Pretwist the conductor.
3. Apply an antioxidant compound to all bolted and compression connections.

D. Interconnections: Interconnect all TGBs with the telecommunications backbone conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot of conductor length, up to a maximum size of No. 3/0 AWG unless otherwise indicated.

E. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install **vertically**

mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.

F. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each TGB to the ground bar of the panelboard.

G. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA-568-C.1 and TIA-568-C.2 when grounding shielded balanced twisted-pair cables.

3.6 IDENTIFICATION

A. Labels shall be preprinted or computer-printed type.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.

    a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.

C. Excessive Ground Resistance: If resistance to ground exceeds **5** ohms, notify Architect.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 270526

SECTION 27 50 10

TELEPHONE, CABLE TELEVISION, AND NETWORK WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Telephone Wiring.

B. Cable Television Wiring.

C. Computer Network Cabling.

D. Accessories.

1.02 REFERENCE STANDARDS

A. BICSI TDMM - Telecommunications Distribution Methods Manual; 13th Edition.

B. FCC Title 47, Part 76 - Multichannel Video and Cable Television Service; 2013.

C. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SYSTEM DESCRIPTION - TELEPHONE

A. Service entrance from local telephone company.

B. Premises wiring for individual dwelling unit telephone service including individual terminal jacks.

C. Combine Telephone and Cable TV jacks into one box where applicable.

1.04 SYSTEM DESCRIPTION - CABLE TELEVISION

A. Service entrance from local cable utility.

B. Premises wiring for broadband distribution of television signal/ internet, including individual outlets.

C. Signal at each outlet: 3 dBmV across 75 ohms, minimum, plus 5 dB, minus 0 dB.

D. Combine Telephone and Cable TV jacks into one box where applicable.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide showing electrical characteristics and connection requirements for each component.

C. 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.

D. Operation Data: Instructions for setting and tuning channels.

E. Maintenance Data: Basic trouble-shooting procedures.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and cable television utility company.

B. Cable television system shall conform to the standards as set forth in FCC Title 47, Part 76.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

D. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 100 miles of the project.

1. Installer shall be capable of providing full system testing, inspection, and maintainence services, including spare parts.

E. Products: Listed, classified and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Manufacturers:
   1. Blonder Tongue Laboratories, Inc: www.blondertongue.com.
   2. Hubbell Electrical Systems: www.hubbell-wiring.com
   3. Channel Master: www.channelmaster.com.
   4. Thomas and Betts: www.tnb.com
   5. Or approved equal.

2.02 ACCESSORIES

A. Coax Demarcation Enclosure: Secure compartment for terminating coax and mounting of spliters and groundblocks for distribution to individual units.
   1. Provide one demarcation enclosure for every Dwelling Unit.
   2. Keptel OPE-92000 or equal.

B. Telephone Tap (Jack)
   1. Recessed, suitable for mounting in standard electrical wall box, type and model suitable to local telephone company.

C. Cable Tap (Outlet):
   1. Recessed, suitable for mounting in standard electrical wall box, all channel, back-matched tap.
   2. Through Loss: 0.7 dB, maximum.
   3. Return Loss: 20 dB, maximum.
   4. Isolation: 12 dB.
   5. Connector: F type coaxial connector.

D. Ethernet/Internet Tap (Cat-6 jack)
   1. Recessed, suitable for mounting in standard electrical wall box, conforming to TIA/EIA-568.
   2. Frequency Range: 250MHz
   3. Connector: 'Keystone' type connector.

E. Splitter:
   1. Inline, all channel, back-matched splitter.
   2. Through Loss: 3.5 dB for two-way; 6.7 dB for four-way.
   3. Isolation: 16 dB, minimum.

F. Main Distribution Cable:
   1. Description: RG11/F or RG6/F as required.

G. Branch Distribution Cable:
   1. Description: RG 6/F.

H. Network Cable:
   1. Description: CAT6 multistrand cable.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Connect cable television service in accordance with cable utility instructions.

C. Install telephone and cable television in accordance with the requirements of BICSI TDMM and NECA/BICSI 568, current editions.

D. Provide proper grounding of telephone and television system components and wiring. Bond outdoor components to lightning protection system.

3.02 CABLE TELEVISION SYSTEM MAINTENANCE

A. Provide service and maintenance of television system for 3 years from Date of Substantial Completion.

END OF SECTION

SECTION 28 10 00
ACCESS CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Access control system requirements.

B. Access control units and software.

C. Access control point peripherals, including readers and keypads.

D. Accessories.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 294 - Access Control System Units; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other installers to provide suitable door hardware as required for both access control functionality and code compliance.
   2. Coordinate the placement of readers with millwork, furniture, equipment, etc. installed under other sections or by others.
   3. Coordinate the work with other installers to provide power for equipment at required locations.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

D. 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 operation of product.

E. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

F. Software: One copy of software not resident in read-only memory.

1.05 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70.
   2. The requirements of the local authorities having jurisdiction.
   3. Applicable TIA/EIA standards.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.07 WARRANTY

A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Access Control Units - Basis of Design: DKS Door King; Series 1838 Access Plus.

B. Access Control Units:
   1. Bosch Security Systems: www.boschsecurity.us.
   2. DoorKing, Inc: www.doorking.com.
   3. Honeywell International, Inc: www.honeywellaccess.com.

C. Readers and Keypads:
   1. Bosch Security Systems: www.boschsecurity.us.
   2. DoorKing, Inc: www.doorking.com.
   3. Honeywell International, Inc: www.honeywellaccess.com.

2.02 ACCESS CONTROL SYSTEM REQUIREMENTS

A. Provide new access control system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Surge Protection:
   1. Provide surge protection for readers and door strikes/locks.

C. Access Control Points:
   1. Exterior Doors:
      a. Function: Operational and emergency.
      b. Access: Controlled entry, free exit.
      c. Peripherals on Secure Side:
         1) Reader/Keypad: Contacless key fob reader.
      d. Locking Device: Electric strike.
         1) Configuration: Fail-secure.
      e. Interface Requirements:
         1) Provide interface with handicapped automatic door operator.

D. Computers Required:
   1. Workstation Computer(s):
      a. Quantity: One.
      b. Location(s): Leasing Office.
      c. Peripherals required for each workstation computer:
         1) Mouse and keyboard.
         2) Monitor(s): One.
         3) Alarm/report printer.

E. Interface with Other Systems:
   1. Provide products compatible with other systems requiring interface with access control system.
   2. Interface with electrically operated door hardware as specified in Section 08 71 00.

F. Provide products listed, classified, and labeled as suitable for the purpose intended.
   1. Access Control Units and Readers: Listed and labeled as complying with UL 294.

2.03 ACCESS CONTROL UNITS AND SOFTWARE

A. Provide access control units and software compatible with readers to be connected.

B. Unless otherwise indicated, provide software and licenses required for fully operational system.

C. Access Control Unit:
   1. Basis of Design: DKS Door King; Model 1838 .
   2. Control Capability: Up to 6 access points or peripherals.
   3. Database:

a. Storage Capacity: 3000 cardholders; 8000 events.
b. Quantity of Access Codes Supported: 1000.

4. Operating Modes Supported:
   a. Card.
   b. Keypad.
   c. Proximety key fob.
5. Features:
   a. Dedicated tamper alarm input.
   b. Dedicated power loss alarm input.
   c. Supports database and event exporting.
   d. Supports database backup.
   e. Integral backup battery system.

D. Computers:
1. Workstation Computers: Unless otherwise indicated, workstation computer hardware and associated peripherals not furnished by access control system manufacturer to be provided by Contractor as part of work of this section, meeting access control system equipment manufacturer's recommended requirements.
2. Servers: Unless otherwise indicated, server hardware and associated peripherals not furnished by access control system manufacturer to be provided by Contractor as part of work of this section, meeting access control system equipment manufacturer's recommended requirements.

E. Products:
1. Access Control Software:
   a. Basis of Design: DKS Door King.

2.04 ACCESS CONTROL POINT PERIPHERALS

A. Provide devices compatible with control units and software.

B. Provide devices suitable for operation under the service conditions at the installed location.

C. Readers and Keypads:
1. General Requirements:
   a. Provide readers compatible with credentials to be used.
   b. Proximity Readers:
      1) Utilize 125 kHz RF communication with compatible credentials.
2. Proximity Reader:
   a. Basis of Design: DKS Door King; Model 1815-305.
   b. Read Range: Up to 12 inches.

D. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 08 71 00.

2.05 ACCESSORIES

A. Provide components as indicated or as required for connection of access control system to devices and other systems indicated.

B. Unless otherwise indicated, credentials to be provided by Contractor.
1. Provide credentials compatible with readers and control units/software to be used.
2. Credential Type: Key fob.

C. Provide cables as indicated or as required for connections between system components.
1. Data Cables for IP Network Connections: Unshielded twisted pair (UTP), minimum Category 6, complying with Section 27 50 10.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install access control system in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Wiring Method: Unless otherwise indicated, use wiring in conduit.
   1. Use suitable listed cables in wet locations, including underground raceways.
   2. Use suitable listed cables for vertical riser applications.
   3. Conduit: Comply with Section 26 05 33.
   4. Use power transfer hinges complying with Section 08 71 00 for concealed connections to door hardware.
   5. Do not exceed manufacturer's recommended maximum cable length between components.

D. Provide grounding and bonding in accordance with Section 26 05 26.

E. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

F. Identify system wiring and components in accordance with Section 26 05 00.

3.03 FIELD QUALITY CONTROL

A. Prepare and start system in accordance with manufacturer's instructions.

B. Program system parameters according to requirements of Owner.

C. Test for proper interface with other systems.

D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Magnetic door holders.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.

1.2 ACTION SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; **Level III** minimum.
    c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product, including furnished options and accessories.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.

8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors according to manufacturer's written recommendations.

12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.

C. Field quality-control reports.

D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in "Operation and Maintenance Data," include the following:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment.
d. Riser diagram.
e. Record copy of site-specific software.
f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

g. Manufacturer's required maintenance related to system warranty requirements.
h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm **Level III** technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

F. NFPA Certification: Obtain certification according to NFPA 72.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: **One** year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, **UL-certified** addressable system, with multiplexed signal transmission and horn/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices **and systems**:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Carbon monoxide detectors.
6. Automatic sprinkler system water flow.
7. Fire-extinguishing system operation.
8. Fire standpipe system.
9. Dry system pressure flow switch.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit **and remote annunciators**.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.

6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
8. Activate preaction system.
9. Recall elevators to primary or alternate recall floors.
10. Activate elevator power shunt trip.
11. Activate emergency lighting control.
12. Activate emergency shutoffs for gas and fuel supplies.
13. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
3. Elevator shunt-trip supervision.
4. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, or remote annunciator.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit **and remote annunciators**.
3. After a time delay of **200 seconds**, transmit a trouble or supervisory signal to the remote alarm receiving station.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event**."

2.4 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment
4. System shall provide capacity for 318 devices per addressable loop.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Touchscreen with virtual buttons for “acknowledge”, “silence”, and “reset”.
2. Touchscreen: Arranged to permit entry and execution of programming, display, and control commands.
3. Provide 5 programmable buttons.

C. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, **Class B**.

D. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

E. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

    a. Elevator lobby detectors except the lobby detector on the designated floor.
    b. Smoke detector in elevator machine room.
    c. Smoke detectors in elevator hoistway.

2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall **be** connected to fire-alarm system.

G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.

H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, **supervisory signals**, **supervisory and digital alarm communicator transmitters, and digital alarm radio transmitters** shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

2.5 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.

1. Double-action mechanism, **pull-lever** type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.6 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be **two**-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Integral Visual-Indicating Light: LED type, indicating detector has operated **and power-on status**.

6. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition **and individually adjustable for sensitivity**.
    a. Multiple levels of detection sensitivity for each sensor.
    b. Sensitivity levels based on time of day.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).
3. Where shown with sounder base, include low-frequency sounds.

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.7 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.

5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.

2.8 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature or a rate of rise.

1. Mounting: **Twist-lock base interchangeable with smoke-detector bases**.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature.

1. Mounting: **Twist-lock base interchangeable with smoke-detector bases**.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.9 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Horns: Electronic-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464.

C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Mounting: Wall mounted unless otherwise indicated.
2. Flashing shall be in a temporal pattern, synchronized with other units.
3. Strobe Leads: Factory connected to screw terminals.
4. Mounting Faceplate: Factory finished, **red**.

2.10 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.11 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: **Flush** cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Touchscreen display shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals, and include 5 programmable buttons.

2.12 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal **to elevator controller to initiate elevator recall, to circuit-breaker shunt trip for power shutdown**.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.13 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Shall be integral to the fire alarm panel and provide point specific information to the central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

C. Equipment Mounting: Install fire-alarm control unit on finished floor.

D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

E. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

F. Smoke- or Heat-Detector Spacing: Comply with NFPA 72.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

I. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

J. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

K. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

L. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

M. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel.

3.3 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated HVAC duct systems.
2. Magnetically held-open doors.
3. Electronically locked doors and access gates.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Supervisory connections at elevator shunt-trip breaker.
10. Supervisory connections at fire-extinguisher locations.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals.

B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by **authorities having jurisdiction**.

B. Perform the following tests and inspections **with the assistance of a factory-authorized service representative**:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for **one** year.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within **one** year from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least **30** days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 284621.11

SECTION 31 31 16
TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 REFERENCE STANDARDS

A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011.

B. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 1947 (Revised 2001).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.

D. Test Reports: Indicate regulatory agency approval reports when required.

E. Test Reports: Submit termite-resistant sheet manufacturer's summary of independent laboratory and field testing for effectiveness in subterranean termite exclusion.

F. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

G. Manufacturer's Instructions: Indicate caution requirement.

H. Record and document moisture content of soil before application.

I. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three (3) years of documented experience.

J. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of three (3) years documented experience.
   2. Approved by manufacturer of treatment materials.
   3. Licensed in the State of Texas.

1.05 WARRANTY

A. Provide five year installer's warranty against damage to building caused by termites.

B. Termite-Resistant Vapor Barrier Sheet: Provide five year manufacturer's limited warranty.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA (Title 7, United States Code, 136 through 136y) approved; synthetically color dyed to permit visual identification of treated soil.

B. Diluent: Recommended by toxicant manufacturer.

C. Manufacturers:
   1. Bayer Environmental Science Corp; Premise Pre-Construction: www.backedbybayer.com/pest-management.
   2. FMC Professional Solutions; Dragnet SFR: www.fmcprosolutions.com.
   3. Syngenta Professional Products; Altriset: www.syngentapmp.com.

D. Mixes: Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Inject toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.
   2. In Crawl Spaces.
   3. At Both Sides of Foundation Surface.
   4. Soil Within 10 feet of Building Perimeter For a Depth of 4 feet.

D. Under slabs, apply toxicant 24 hours prior to installation of vapor barrier.

E. At foundation walls, apply toxicant 12 hours prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 INSTALLATION - BARRIER SHEET

A. Comply with ASTM E1643.

B. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

3.04 PROTECTION

A. Do not permit soil grading over treated work.

B. Protect sheet materials from damage after completed installation. Repair damage with manufacturer's recommended products and according to the manufacturer's written instructions.

END OF SECTION

SECTION 32 33 00
SITE FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bench(es).

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, and maintenance information.

1.04 WARRANTY

A. Provide manufacturer’s warranty against defects in materials or workmanship for a period of 10 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 METAL FURNISHINGS

A. Metal Furnishings, General:
   1. Pipe: Carbon steel, ASTM A53/A53M, Schedule 40.
   2. Tube: Carbon steel, ASTM A500/A500M.
   3. Steel components: Plates, bars, and shapes complying with ASTM A36/A36M and tubing complying with ASTM A500/A500M; cleaned, treated, and vinyl-coated.
      a. Color: As selected by Owner from manufacturer's standard range.
   4. Hardware: Stainless steel.

B. Bench(es): Metal frame and seat section with back; thermoplastic coated (Plastisol).
   1. Frame: Steel.
   2. Seat: Punched steel.
   3. Length: 60 inches.
   4. Mounting: Embedded in concrete.
   5. Products:
      a. Belson Outdoors LLC; Model #940SM-V6
      b. Or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect areas and conditions before installation. Notify Architect in writing of unsatisfactory or detrimental conditions. Do not proceed until conditions have been corrected. Commencing installation constitutes acceptance of work site conditions.

B. Verify proper installation of mounting surfaces, preinstalled anchor bolts, and other mounting devices; and ready to receive site furnishing items.

3.02 INSTALLATION

A. Install site furnishings in accordance with the Contract Documents, approved shop drawings, and manufacturer's installation instructions.

B. Coordinate installation of inserts and anchor bolts that must be built in to concrete slabs.

C. Secure all site furnishings with manufacturer's recommended anchoring devices.

D. Provide level mounting surfaces for site furnishing items.

END OF SECTION